Serial Number _____

CK4 INSTRUMENT AND CORRDATA™ CK SOFTWARE REFERENCE MANUAL

CORRDATA™ CK Software
for CK4 CORROSOMETER® instrument,
CORROSOMETER®, and CORROTEMP™ Probes

ROHRBACK COSASCO SYSTEMS, INC.
11841 E. Smith Avenue
Santa Fe Springs, CA 90670
Tel: (562) 949-0123
(800) 635-6898
Fax: (562) 949-3065

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CORRDATA™ Corrosion Monitoring System
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Chapter 1
Introduction

The Model CK4 CORROSOMETER instrument is designed to read CORROSOMETER and CORROTEMP probes, and to simplify both probe reading and data presentation. CORROTEMP probes incorporate temperature measurement into the standard CORROSOMETER probes, without any additional connections.

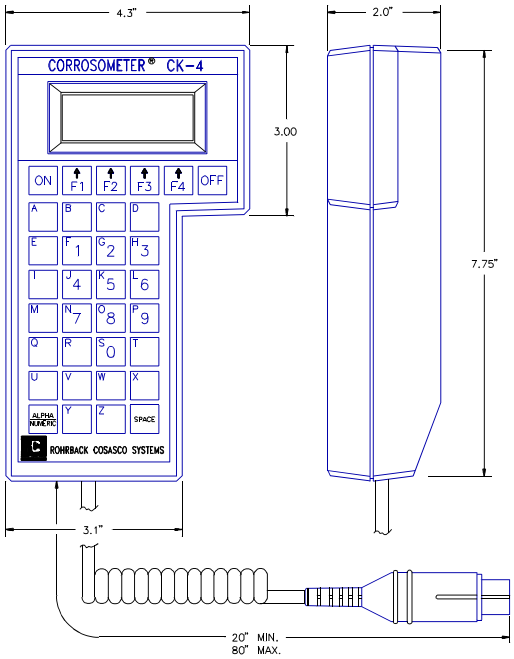

Figure 1.1 CK4 CORROSOMETER Instrument

The CK4 joins a new generation of multi-parameter corrosion monitors, including the CORRDATA Mate II, designed to read both metal loss and temperature. This portable unit has a built-in memory which stores readings for later retrieval, so that operators do not have to carry a notebook and pencil for manual recording.

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The combination of corrosion and temperature measurement is particularly useful in process plants, chemical plants and refineries, where changes in operating temperature can have a major impact on corrosion rates. High temperatures that push or exceed the design conditions may improve output, but may result in unacceptably high corrosion rates. The CK4 brings direct correlation between temperature and corrosion rate from one instrument.

The CK4 instrument allows readings to be stored for up to 26 probes. This stored data is later retrieved on the CK4 and entered into the CORRDATA CK Graphical Software package. This software package is supplied free of charge with each instrument.

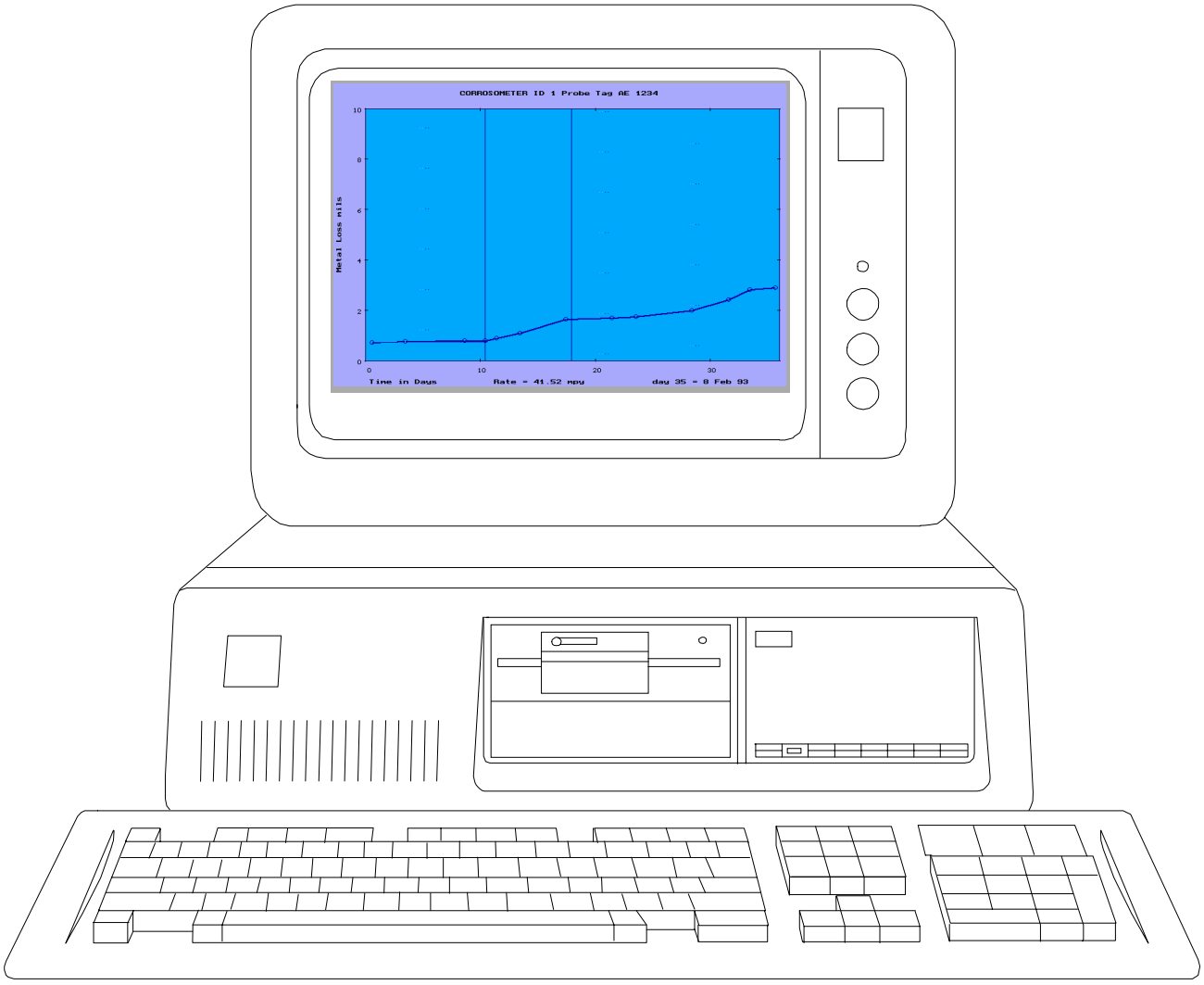

Figure 1.2 Data display on P.C.

Graphical displays of metal loss against time, and temperature against time are immediately available for analysis and print-out. Cursors allow selection of any portion of the graphs for automatic statistical computation of corrosion rates, or average temperature on CORROTEMP probes. 1,131 probe readings on each probe can be displayed, and zooming in can be done to as little as one day. MS DOS graphics enables any screen to be printed at the touch of a button.

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Chapter 2
Specification

CK4 CORROSOMETER Instrument

Electronics

- Compatible with all CORROSOMETER and CORROTEMP probes
- LCD Readout
- Sealed membrane keyboard
- Metal loss resolution - 0.1% of probe span
- Metal loss repeatability - ± 0.5% of probe span
- Temperature resolution - 1^0 C
- Temperature accuracy - ± 3^0 C including probe sensor
- Power Supply - 6 AA Alkaline cells
- Battery Life - Typical 8 hours of continuous operation
- Automatic power shut off in 45 secs after reading or non-use
- Supplied with test probe
- Reading memory for 26 probes

Mechanical

- Splash-proof enclosure
- Dimensions 7.75"H x 4.30"W x 2"D (196.8 mm x 109.2 mm x 50.8 mm)
- Supplied in carrying case
- Weight without carrying case 1.5 lb. (680 g)
- Weight with carrying case 5.5 lb. (2.5 Kg)

Environmental

- Temperature range:
  Operating - 0ºF to 122ºF (-18ºC to 50ºC)
  Storage - 0ºF to 150ºF (-18ºC to 70ºC)
- Humidity 0 - 95% (non-condensing)

P.C. Requirements

- IBM P.C. or compatible
- VGA or EGA graphics
- 640k memory
- 1 floppy disk drive
- Hard disk (Memory requirement: 400K plus 40K per probe)
- MS DOS 3.3 or higher operating system (MS DOS 4.01 or 5.0 preferred)

Chapter 3
Installation

NOTE: *Your CK4 instrument was carefully tested, inspected and packaged prior to shipment. Before unpacking the instruments, please inspect the packaged materials for shipping damage and retain damaged packaged materials to support any claim against your freight carrier should this become necessary.*

Unpacking

Carefully remove the instruments from their packages. Included in the package you should find:

CORROSOMETER CK4 Instrument

- Hand held CORROSOMETER CK4 instrument.
- Instrument carrying case.
- CK4 and CORRDATA CK Software Quickstart and Reference Manuals.
- CORRDATA CK Software Diskettes.
- CORROSOMETER/CORROTEMP test probe.

Intrinsic Safety

The probes, and CK4 instrument have intrinsic safety ratings for use in electrical hazardous area environments. Applicable certifications are identified on the System components according to units ordered.

The intrinsically safe system has been certified with a rating of EEx ia IIC T4 at temperatures of up to 50^0C. For temperatures from 50^0C to 70^0C the rating is EEx ia IIC T3. This means that the system is safe for use in the severest of electrical hazardous areas, where explosive gases are always present (Zones 0, 1, and 2; Divisions 1 and 2, all groups) even with up to two fault conditions (designated by ia).

The gas classification IIC is the most stringent including gases such as acetylene and hydrogen. This part of the rating relates to the spark energy that is required to create an explosion.

Gases have a separate classification for explosive tendency based on hot surface temperatures which are not necessarily the same as the spark ignition energy. The temperature rating T4 indicates that no temperature of the equipment exceeds 135^0C at 50^0C even under fault

conditions. This rating includes all listed gases except carbon disulphide (which requires T5 rating)

Care must be taken with intrinsically safe systems to maintain their carefully designed integrity. The major features to note are as follows:

1. The batteries in the CK4 instrument must be replaced in a safe area even if the unit is intrinsically safe, since the standard alkaline batteries are only safe if housed in a suitable enclosure.

2. Absolutely no substitution of parts or unauthorized repairs must be undertaken or the certifications are rendered invalid.

CORROSOMETER CK4 Instrument

The CK4 is supplied with a set of six 1.5 V AA alkaline batteries. To install these batteries remove the access panel on the back of the unit (see Figure 3.3) and install the batteries with the polarities as indicated.

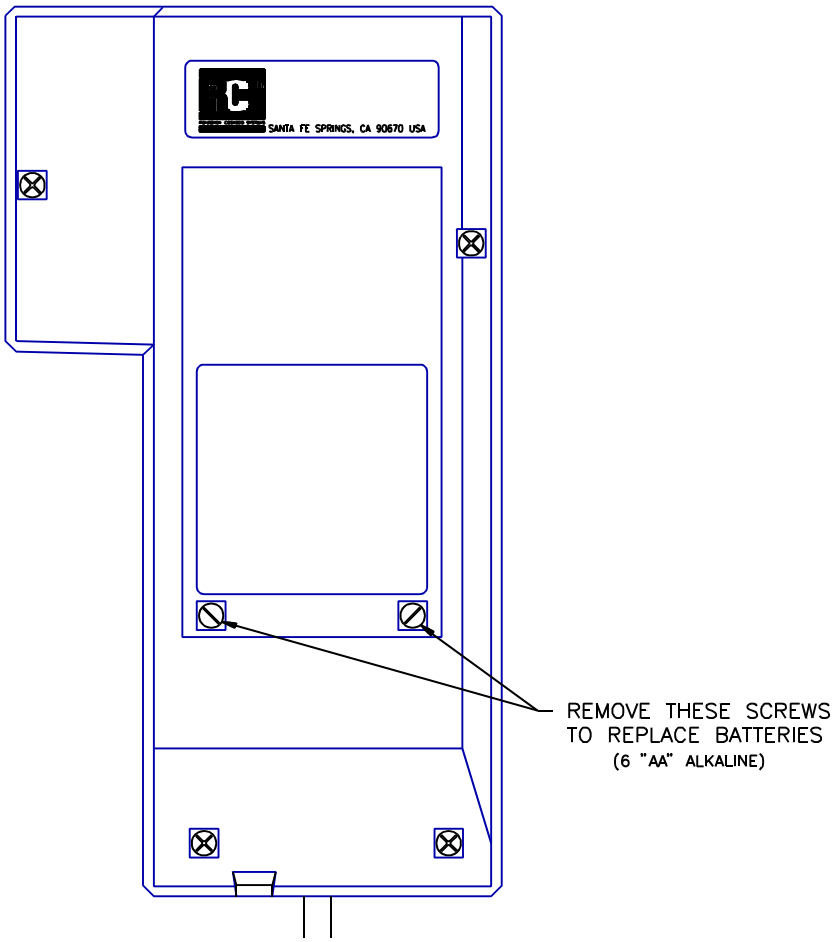


Figure 3.1 Battery Replacement on CK4

To check that the unit is operational press the ON button. The screen should appear as in Figure 3.4.

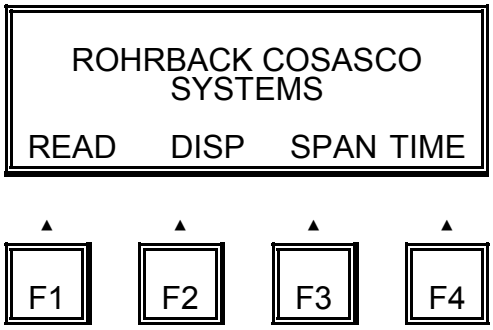
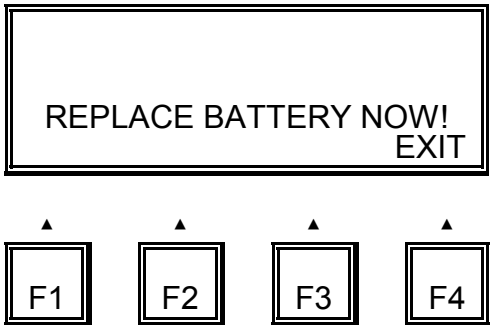


Figure 3.4 CK4 Start-Up Screen.

If the batteries are low or in need of replacement, a warning screen will appear as follows.



The battery is tested both at initial switch on, and during probe measurement.

Battery back up for memory in the Mate II is provided by lithium batteries mounted internally within the unit. These batteries should provide 7-10 years of back up capacity. Replacement of these batteries requires the unit to be returned to Rohrback Cosasco Systems or an authorized dealer.

CORRDATA CK Software

The minimum requirements for the P.C. are as follows:

- ♦ IBM P.C. or compatible.
- ♦ EGA/VGA graphics card.
- ♦ 640 K memory.
- ♦ One floppy disk drive.
- ♦ Hard disk.
- ♦ MS-DOS 3.3 or higher operating system (MS-DOS 4.01 or 5.0 preferred)

The CORRDATA CK Software package is included with the CK4 instrument. Both 3½ and 5¼ low density diskettes are supplied for maximum compatibility.

To install the CORRDATA CK Software, place the appropriate diskette in your floppy drive. At the DOS prompt, change the drive to this floppy and type **install**. Follow the on-screen instructions.

> ***NOTE:*** *The install program also requests selection of COM1 or COM 2 serial port. Although the serial port is not used with manual input readings from the CK range of portable instruments, this program is also capable of operating with the CORRDATA Remote Data Collectors, and Mate I or II probe reading and data transfer units. These systems allow fully automated data collection and direct transfer to the P.C. without the need for any manual data transfer. For further details contact Rohrback Cosasco Systems Inc.*

The default directory is CORRDATA and is installed in the root directory of the C drive.

When the installation is complete, remove the CORRDATA CK Software diskette and save as a backup. To commence the program select the CORRDATA directory and then type "CK".

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Chapter 4
System Overview

CORROSOMETER CK4 Instrument

The CK4 is a portable instrument capable of reading either CORROSOMETER or CORROTEMP probes. CORROTEMP probes are the same as CORROSOMETER probes, but have an additional temperature measurement incorporated. This measurement is incorporated without any additional connectors or connectors pins. Both the metal loss and temperature readings are recorded by the CK4 and the readings can be stored in up to twenty-six memory locations, for later retrieval and transfer to the graphical CORRDATA CK Software supplied with the instrument. This reading storage capability avoids the need to manually write down the probe readings. CORROTEMP probes may be recognized by the name on the probe body and the letter "T" after the probe model number.

CORRDATA CK Software

The CORRDATA CK Software supplied with the CK4 provides the following features.

- Menu style selection.
- Probe configuration.
- On-line help screens.
- Selection of units (mils, millimeters or micrometers).
- Graphical display of metal loss data for CORROSOMETER probes.
- Graphical display of metal loss and temperature from CORROTEMP probes.
- Zooming in on graphical displays.
- Editing of metal loss data to show corrosion rates over selected periods, and dates of selected period.
- Up to 1131 corrosion data points may be displayed for each probe.

In the CORRDATA CK Software program provision has been made for future development and extension of integrated corrosion data. This is apparent by some "grayed" or " barely visible" menu items. These items are not accessible in this software release.

In addition, this program may be used as an add-in the CORRDATA Basic Software program to provide manual input capability to the fully automated system which the CORRDATA system provides. This is useful to customers that have both CK3 or CK4 instruments and CORRDATA systems.

A typical CORROSOMETER probe data entry screen is shown below in Figure 4.1. A typical CORROSOMETER or CORROTEMP probe metal loss graph output is shown in Figure 4.2. For a CORROTEMP probe it is possible to toggle between the metal loss graph and the temperature graph, such as shown in Figure 4.3, by pressing the key "T".

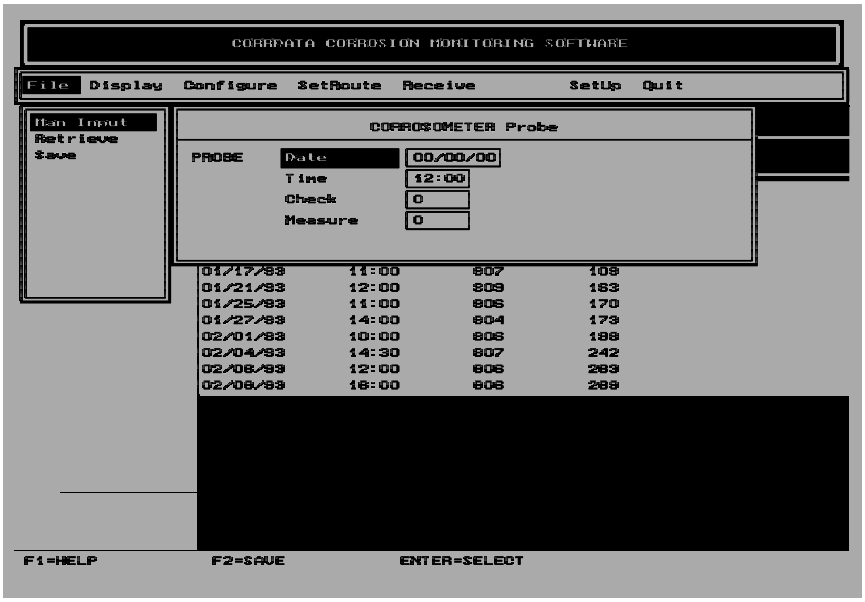

Figure 4.1 Typical CORROSOMETER Probe Data Entry Screen

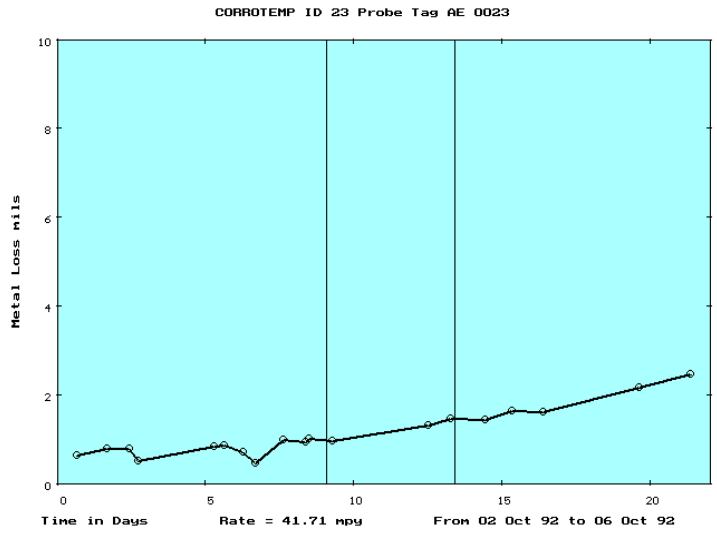

Figure 4.2 Typical CORROSOMETER or CORROTEMP Probe Metal Loss Graph

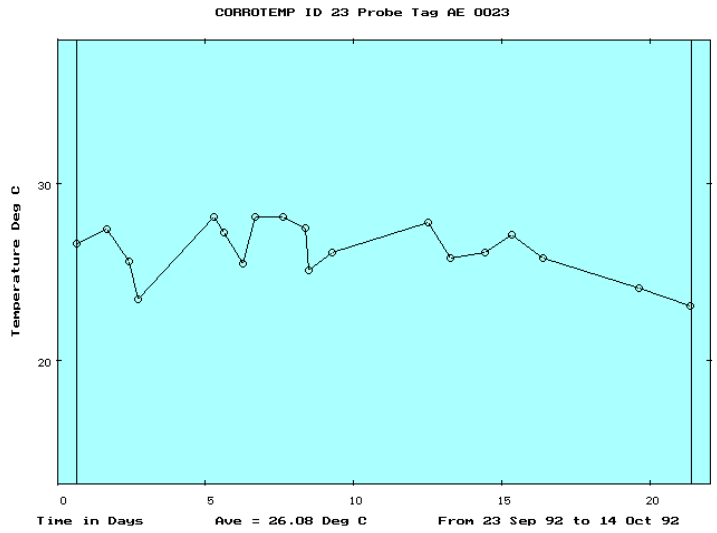

Figure 4.3 Typical CORROTEMP Probe Temperature Graph

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Chapter 5
System Configuration Procedures

Entering Probe Configuration information on the P.C.

CORROSOMETER and CORROTEMP probe configuration data is easily entered on the P.C. with CORRDATA CK Software. This configuration is subsequently used for displaying the manually entered probe readings in engineering units on graphical displays.

To commence probe configuration on the P.C., select the CORRDATA directory in which the CORRDATA program is located and type **CK** to start the program. Press **Enter** to clear the RCS CORRDATA CK introduction screen, and display the main menu. Help screen information is available via the F1 key for the menu items.

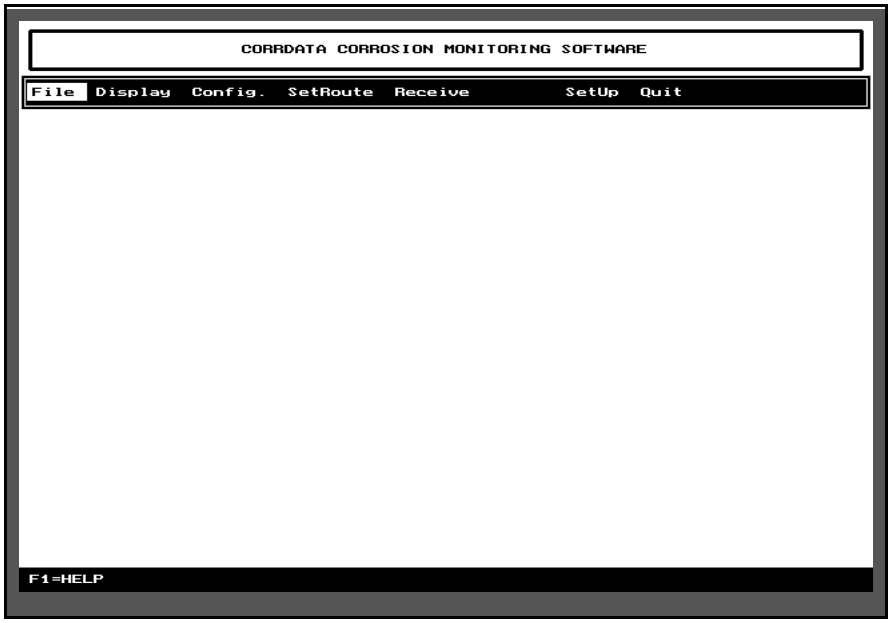


Figure 5.1 Main Menu Screen

From the main menu and sub-menu select **SetUp**, and **Units**. Select the engineering units required for display purposes from **mils** (.001"), **millimetres** (mm), or **micrometres** (µm), and press **Enter**.

For first time probe configuration select **Configure**.

> ***NOTE:*** *Menu items may be selected using the cursor keys, space bar, tab (forward), shift + tab (backward) keys and* ***Enter****, or by typing the highlighted letter.*

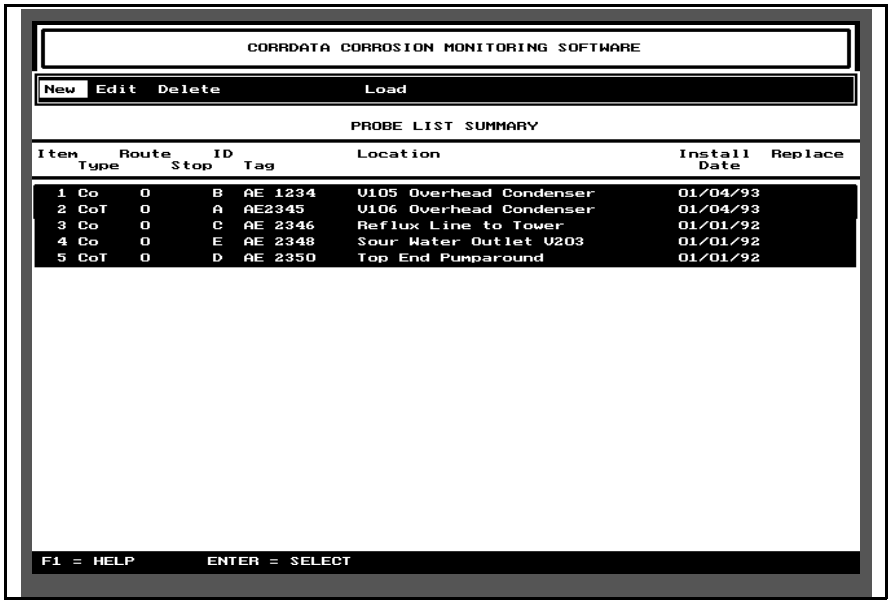

CORRDATA CORROSION MONITORING SOFTWARE
New Edit Delete Load
PROBE LIST SUMMARY
Item Route ID Location Install Replace
Type Stop Tag Date
1 Co O B AE 1234 V105 Overhead Condenser 01/04/93
2 CoT O A AE2345 V106 Overhead Condenser 01/04/93
3 Co O C AE 2346 Reflux Line to Tower 01/01/92
4 Co O E AE 2348 Sour Water Outlet V203 01/01/92
5 CoT O D AE 2350 Top End Pumparound 01/01/92
F1 = HELP ENTER = SELECT

Figure 5.2 Configuration Mode - Probe List Summary.

For this first time configuration, or for new additions to the existing list, select NEW to display the sub-menu of input selections.

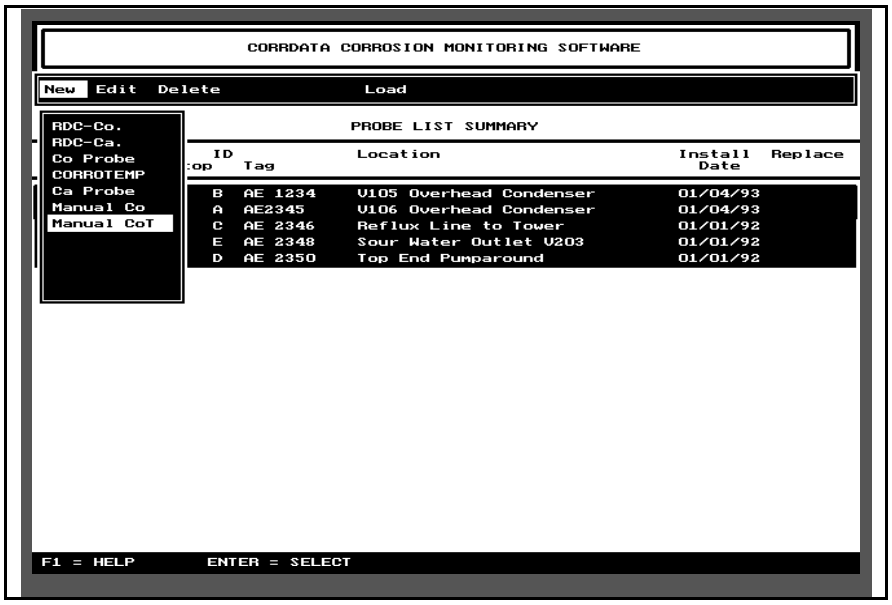

CORRDATA CORROSION MONITORING SOFTWARE
New Edit Delete Load
RDC-Co.
RDC-Ca.
Co Probe
CORROTEMP
Ca Probe
Manual Co
Manual CoT
PROBE LIST SUMMARY
ID Top Tag Location Install Date Replace
B AE 1234 V105 Overhead Condenser 01/04/93
A AE2345 V106 Overhead Condenser 01/04/93
C AE 2346 Reflux Line to Tower 01/01/92
E AE 2348 Sour Water Outlet V203 01/01/92
D AE 2350 Top End Pumparound 01/01/92
F1 = HELP ENTER = SELECT

Figure 5.3 Configuration Mode - Input Selection.

Select **Manual Co** (Manual CORROSOMETER) for CORROSOMETER probe configuration or **Manual CoT** (Manual CORROTEMP) for a CORROTEMP probe configuration. This will display any existing entries on the probe list together with an entry menu bar, such as the list in Figure 5.2.

> ***NOTE:*** *The other selections in this sub-menu are not applicable to use of this program with the CK4 instrument. They are part of the CORRDATA software for the fully automated data collection that may be achieved with Remote Data Collectors (RDC's) and either a Mate I or Mate II data transfer unit. To see a demonstration of the capability of this type of system, retrieve the demonstration graph* ***DEMO.SAV*** *as described later in the section "Archiving and Retrieving Old Data Files".*

Press **Enter** to bring up the information entry screen. For a CORROTEMP probe, the screen would appear as follows.

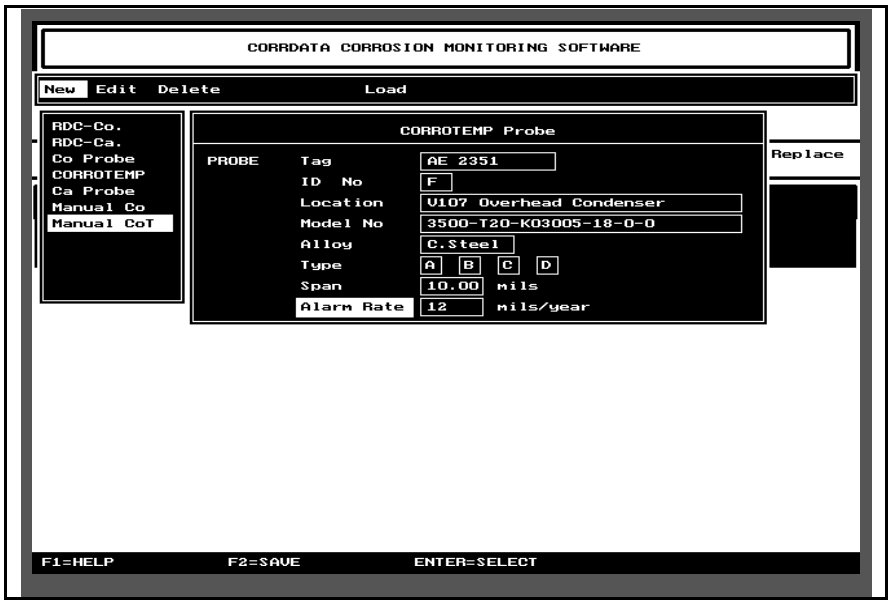


Figure 5.4 Configuration Mode - CORROTEMP Probe Information Entry Screen.

The dialogue box provides for all the information needed for this probe. Some items must be completed, while others are optional.

For an CORROSOMETER or CORROTEMP probe, the fields that must be completed are:

a)	ID Number	(Range 1 to 50 and A to Z)
b)	Type	(See Probe or Figure 5.5)
c)	Span	(See Probe or Figure 5.5)

Use the ↑ or ↓ keys to move between the highlighted entry fields. Press the **Enter** key to gain access to the data entry box. Type in the required data, using the backspace, → or ← arrows, or delete keys as necessary. For fields with pre-selected values use the → or ← arrows. When a field entry is correct, press **Enter** to complete.

The entry screens for each type of probe are similar except as noted below:

Probe Tag This is an optional field of 12 character maximum, normally used for probe tag numbers such as AE 3041. Alternatively, a brief description or location may be used.

ID No. This is the letter or number to be allocated to this probe. Each ID must be a unique. A letter, upper case A to Z, is ideal as this can be used as the probe

memory location on the CK4. Numbers between 1 and 50 may also be used. This is the primary means of identifying each probe.

Location This is an informational field only which allows additional identification information up to 30 characters in addition to the tag number field.

Model Number This is a convenient field to store the probe identification information which can be useful for reordering purposes. Example: 3500-T10-K03005-18-0-0-0.

Alloy This is the field for identification of the probe element alloy for CORROSOMETER and CORROTEMP probes. Typically the UNS alloy code is used such as K03005 for pipe grade carbon steel. Alternatively Carbon Steel, 304 SS, or Monel 400, or similar may be used if within the 8 character maximum.

Type For CORROSOMETER and CORROTEMP probes this is the probe type identified on the probe and detailed in Figure 5.5.

Span This is identified on the probe and entered in mils even if millimetres or micrometres display units are selected. The mils range is the only figure listed on the probe for reasons of space.

Alarm Rate This is provided for informational purposes only. Since the corrosion data is historical, active current alarms in the normal sense are not applicable.

Once all the necessary information has been completed on this screen and is correct, press **F2** to save the information. This will then return to the configuration mode - input selection Figure 5.3.

Repeat the procedure with the next probe entry until all the necessary entries have been completed. When the final entry has been saved, use the **Esc** key as necessary to move back up the menu tree.

To edit any of the entries, select **Configure** from the main menu to display the existing probe list summary. Use the arrow keys to move the highlight bar to the required probe. Select **Edit** from the menu bar. The information entry screen will appear which may then be edited as required and saved with the **F2** key. If you wish to exit without making any changes use the **Esc** key.

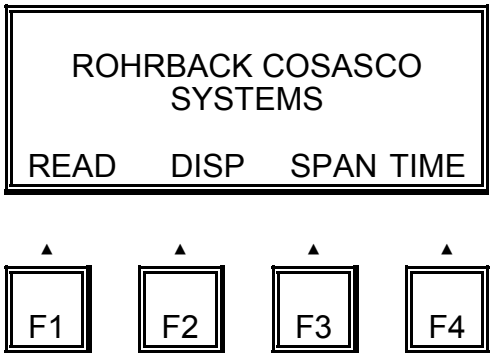
WARNING! ***Editing is primarily for use at initial configuration. Changing probe type, span, after data has been collected may distort the data.***

To delete an entry select **Configure** from the main menu to display the probe list. Select the required entry with the highlight bar, and select **Delete** from the menu bar.

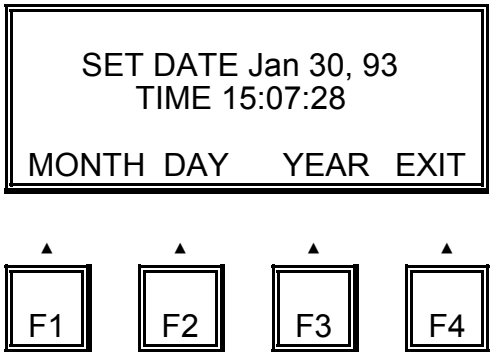
Once all the configuration information has been loaded into the P.C., the program is ready to receive the first set of probe data.

Setting the Clock on the CK4

The CK4 has its own clock so that individual probe readings are automatically date and time stamped. To set the CK4 clock, switch **ON** the CK4, which will display the following screen.

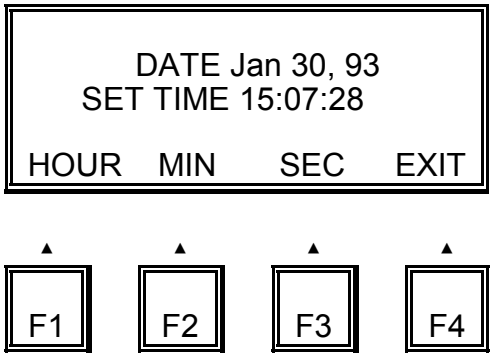


Press **TIME** (F4)



To set the month, press **MONTH** (F1) once to increase. Hold down the key to scroll through the months. To reverse the direction of scrolling, press the **ALPHA /NUMERIC** key once. To toggle back the scrolling direction,press the **ALPHA/NUMERIC** key again. Follow the

same procedure to change the **DAY** (F2), and the **YEAR**(F3). When complete press **EXIT** (F4). This will change the screen to the following.



To set the hour, press **HOUR** (F1) once to increase. Hold down the key to scroll through the hours. To reverse the direction of scrolling, press the **ALPHA /NUMERIC** key once. Press the **ALPHA/NUMERIC** key to return to forward scrolling again.

> ***WARNING!*** ***The hour is set on the military 24 hour clock, where 00:00 hours is midnight at the start of the day, and 12:00 is mid-day.***

Follow the same procedure to change the **MIN** (F2), and the **SEC** (F3). When complete press **EXIT** (F4) to return to the main menu.

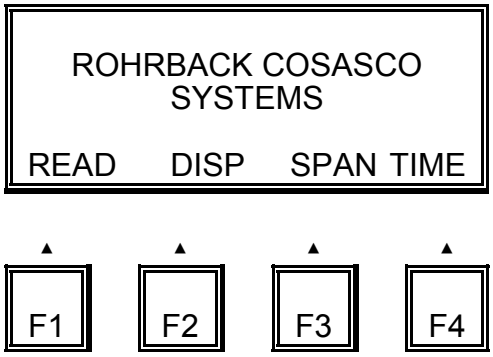
Configuration of CK4 Probe Span

Corrosion rate data is best reviewed and analyzed in graphical form on the P.C. where the trend through many points is possible.

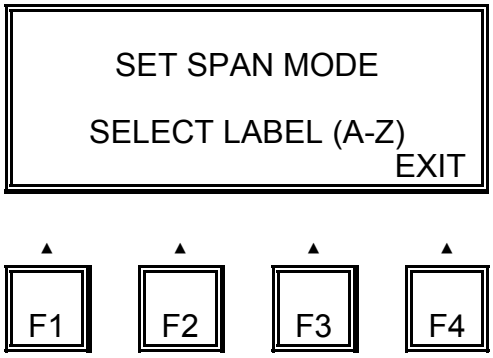
> ***NOTE:*** *The highest resolution of historical corrosion data is obtained with a CORRDATA system using Remote Data Collectors (RDC's) which record probe readings at regular intervals from every 5 minutes to every 24 hours. This provides enhanced detection of corrosion upsets.*

Input of probe span is only necessary if an approximate corrosion rate calculation is required on the CK4 at the time of reading. This corrosion rate is then based on the current and last probe reading only. If this calculation is not required on the CK4, this section of the configuration may be omitted.

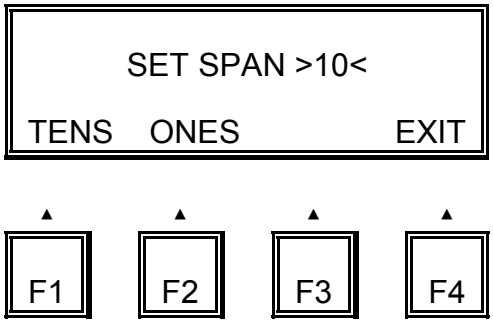
First switch **ON** the CK4.



Press **SPAN** (F3).



Press the key (A-Z) corresponding to the probe label to be configured. Normally, the probes on the system will have been labelled with letters A up to as high as Z. Using the same identification on the CK4 for the probes will keep identification simpler and avoid confusion. The following screen will be displayed.



Press the **TENS** (F1) key to increase the tens value, and press the **ONES** (F2) key to increase the units value of the probe span. Hold down the key to scroll up through the values. To reverse the direction of scrolling, press the **ALPHA/NUMERIC** key once before using the **TENS** or **ONES** keys; press the **ALPHA/NUMERIC** key again to toggle back to the normal

scrolling. Enter the probe span in mils as marked on the probe, irrespective of the units chosen in the **SetUp** of the P.C. program. The probe spans for various probe types are also listed in Figure 5.5

NOTE: *A corrosion rate will only be computed on the CK4 instrument display if the probe readings are more than fourteen days apart.*

CORROSOMETER or CORROTEMP Probe Element	Type	Span (mils)
Strip Loop S4	C	1
Flush Element S4 Atmospheric Element S4 Strip Loop S8 Tube Loop T4	B D C B	2
Flush Element S8 Atmospheric Element S8 Tube Loop T8	B D B	4
Flush Element S10 Cylindrical Element T10	B D	5
Flush Element S20 Cylindrical Element T20 Wire Loop Element W40	B D A	10
Wire Loop Element W45	A	11.25
Flush Element S20 Wire Loop Element W80	B A	20
Cylindrical Element T50	D	25

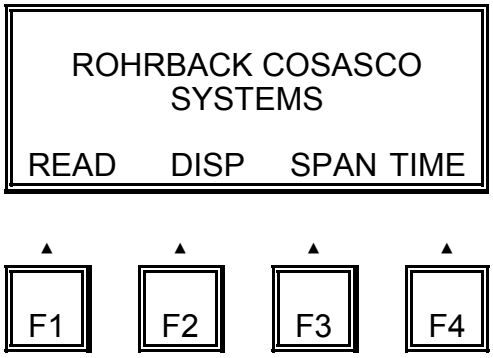
Figure 5.5 CORROSOMETER and CORROTEMP Probe Types and Spans

CAUTION: *CORROSOMETER Model 2500, 3500, or 4500 probes are designated as a "cylindrical" element, not a "tube" element which refers only to "tube loop" elements. If tube/strip or wire element is selected but a cyclindrical element is being read the measurement will return as "-90". Please select the correct probe type.*

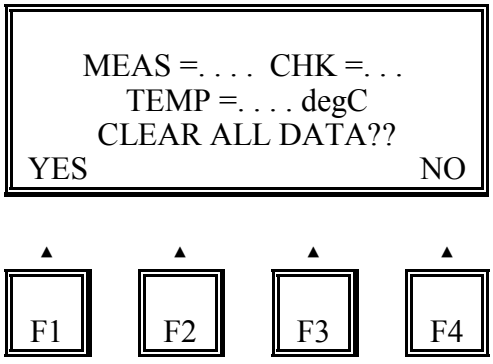
Clearing Memory on CK4

Normally it will not be necessary to clear the memory on the CK4 unless extraneous entries have been made, for example, when initially experimenting with the system. Alternatively, if the equipment is to be transferred to a new location, then it is recommended to clear the memory to avoid confusion with any previously collected data. To clear the memory, proceed as follows.

Switch **ON** the CK4.



Press **READ** (F1),and from the sub-menu select **WIRE** (F1). Then press in sequence **F1**, **F2**, and **F3**. The screen will display the following.



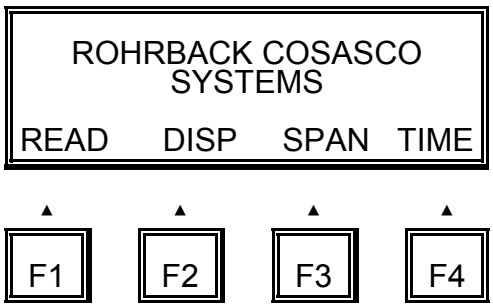
Select **YES** (F1) to complete the deletion, or **NO** (F4) to exit without clearing the memory.

Chapter 6
Normal Operating Procedures

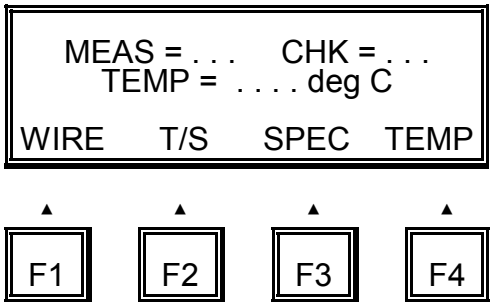
Once the probe configuration has been entered on the P.C., the ID designation letters should be noted and the probes marked accordingly on the probes. This reduces the possibility of entering the probe reading in an incorrect memory location.

Reading CORROSOMETER Probes

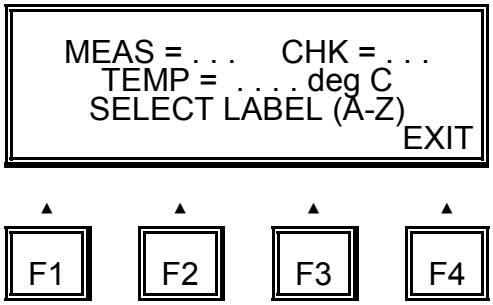
At the first CORROSOMETER probe to be read, remove the connector cap from the probe, plug in and switch **ON** the CK4.



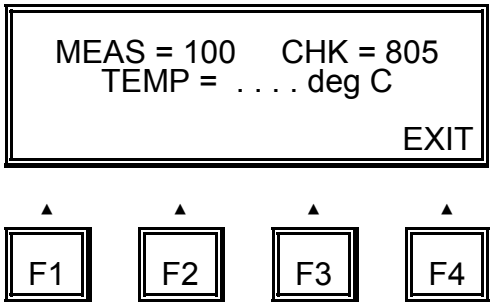
Press **READ** (F1).



Select the probe type with the F keys, or with the keys **A**, **B**, **C**, or **D**. Wire element probes are type A; Tube/Strip (T/S) loop and flush probes are type B or C; Special or cylindrical element probes are type D. This will display the screen.



Select and press the key (A-Z) corresponding to the probe identification. The CK4 will then take approximately 2 minutes and 45 seconds to read the probe. The CK4 will indicate that a reading is in process, and when complete will indicate readings such as the following.



NOTE: *Corrosion "measure" and "check" readings are displayed in units of " divisions". 0 to 1,000 divisions represents 0 to 100% of the useful probe life, or probe span. One division is 0.1% of the probe span. These units are converted to engineering units automatically from the probe configuration information entered in the CORRDATA CK software program.*

Various warning messages may occur if there is any problem with the probe reading.

Message	Action
Replace Probe Soon!	Probe life is 80% consumed. Prepare a replacement
Replace Probe Now!	Probe life is 95% consumed. Replace now.
Probe at end of Life	Probe life is exceeded. Replace Probe
Check Reading Bad!	The internal probe reference element is damaged. Replace probe.
Replace Batteries	Replace batteries in an electrically safe area

NOTE: *A shorter reading time may be achieved by pressing the* ***SPACE*** *key before selecting the probe letter against which to store the probe reading. This reading takes approximately 1 minute, but will not be as accurate as the normal reading.*

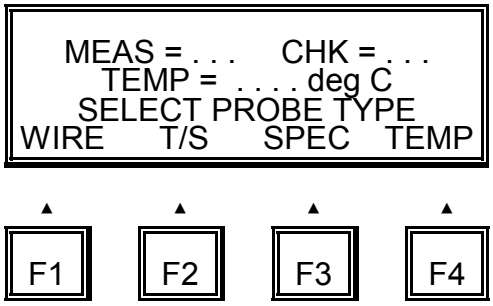
When the reading is complete, press **EXIT** (F4) to return to probe type selection screen, or switch **OFF** the CK4 and proceed to the next probe to be read.

NOTE: *The CK4 has an automatic shut-off 45 seconds after a probe has been read or if the instrument is inactive, in order to conserve the batteries.*

Reading CORROTEMP Probes

Reading the corrosion data on a CORROTEMP probe is exactly the same as for the CORROSOMETER probes described above. To read the temperature on these probes, select **TEMP** instead of probe type as follows.

Switch **ON** the CK4 and select **READ** (F1) to show this screen.



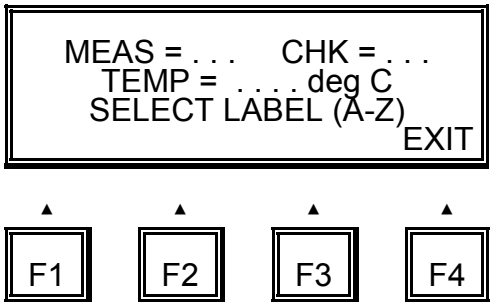
Press **TEMP** (F4). The instrument will indicate that the probe temperature is being read. After approximately 45 seconds the probe temperature reading will be displayed along with the measure and check probe readings if these have already been taken on this probe.

WARNING! ***For CORROTEMP probes, remember to read both the corrosion and the temperature data.***

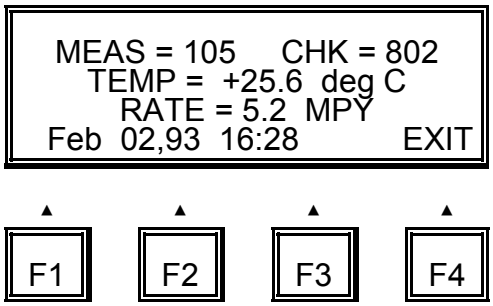
NOTE: *Actual date and time display is linked to the corrosion data, since there is limited display space to show it separately for both temperature and corrosion data. This is not a problem if both corrosion and temperature readings are taken at the same time, as recommended. However it would have an effect if the corrosion and temperature were taken at significantly different times on a particular probe.*

Displaying Probe Data on the CK4

Probe data may be reviewed on the CK4 at any time, either in the field or at the P.C. for transfer to the CORRDATA CK Software package. To display the data, switch **ON** the CK4 instrument, and press **DISP** (F2).



Press the key (A-Z) for the probe to be reviewed. This will show a display similar to the following.



NOTE: *The corrosion rate on the third line of the display is computed on the metal loss from the previous reading only. The value will only be displayed if the readings are at least 14 days apart. No negative rates will be displayed, if for some unusual reason the reading decreased from the previous one. Rates will also not be computed for data points more than 365 days apart.*

Replacing Probes

Warnings of impending probe replacement is given both on the CK4 instrument at the time of reading, and on the CORRDATA CK software probe summary list.

If the probe being replaced is of the same type, the reading on the CK4 instrument is carried out as normal once the probe has been replaced. On the P.C., the previous probe data should be archived as described later in this chapter, and the probe configuration deleted from the **Configure** menu. The probe should then be reconfigured as a **New** probe with the same ID. This process clears the old readings from the current probe list and re-initializes the new "check" reading. This first "check" reading becomes the reference against which the subsequent "check' readings are compared for checking the reference element integrity.

NOTE: *A bad "check" reading causes the subsequent graphical displays to have a thin line instead of the normal thick line.*

If the probe being replaced is of a different span, the probe span on the CK4 should be changed accordingly. If the probe is of a different type make sure that the correct type is entered on the CK4 at the time of reading. On the P.C., archive the old probe data as described later in this chapter, delete the old probe data by deleting the probe from the **Configure** menu. Enter the new probe configuration information, and then the new probe data. The first probe data entered then becomes the reference for the subsequent "check" readings.

Entering Probe Data into the P.C.

When all the probe data has been collected on the CK4, it is time to transfer the data to the CORRDATA CK software program. The CORRDATA program provides immediate graphing of the probe data, automatic corrosion rate calculation of any selected data, printing of the graphs, and archiving of the data for future reference.

To commence probe data entry, start the CORRDATA CK program, and from the main menu select **File**, and from the sub-menu **Man Input**. This will display the listing of configured probes.

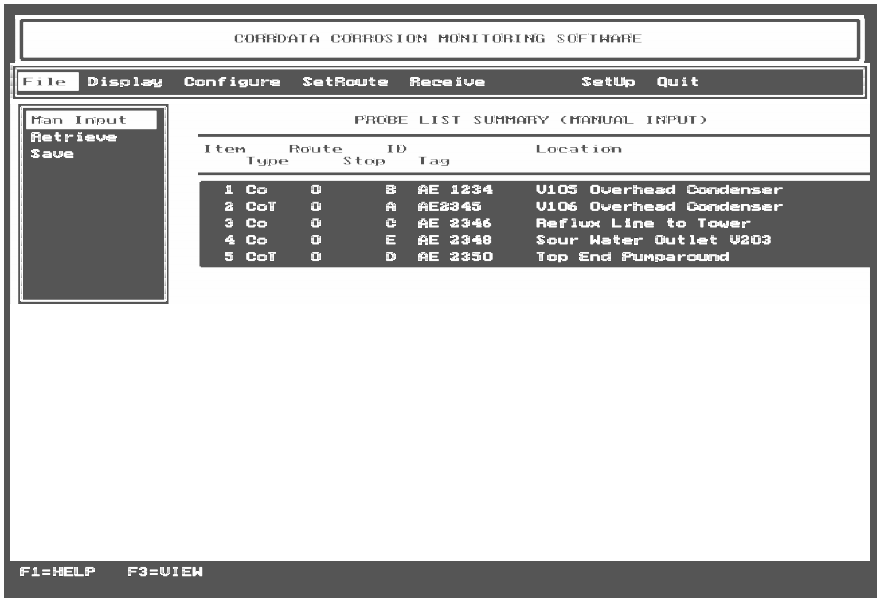

CORRDATA CORROSION MONITORING SOFTWARE
File Display Configure SetRoute Receive SetUp Quit
Man Input
Retrieve
Save
PROBE LIST SUMMARY (MANUAL INPUT)
Item Route ID Location
Type Stop Tag
1 Co 0 B AE 1234 V105 Overhead Condenser
2 CoT 0 A AE2345 V106 Overhead Condenser
3 Co 0 C AE 2346 Reflux Line to Tower
4 Co 0 E AE 2348 Sour Water Outlet V203
5 CoT 0 D AE 2350 Top End Pumparound
F1=HELP F3=VIEW

Figure 6.1 Manual Input Probe List

NOTE: *If this program is used as an add-in to the CORRDATA program for Mate I or Mate II to permit additional input from a CK3 or CK4 instrument, this list will only display probes that have been configured for manual input. This simplifies selection of manual entry probes, and avoids confusion with fully automated data entries.*

Use the ↑ and ↓ keys to select the probe for which data is to be input, and press the **Enter** key. This will bring up the probe data input screen.

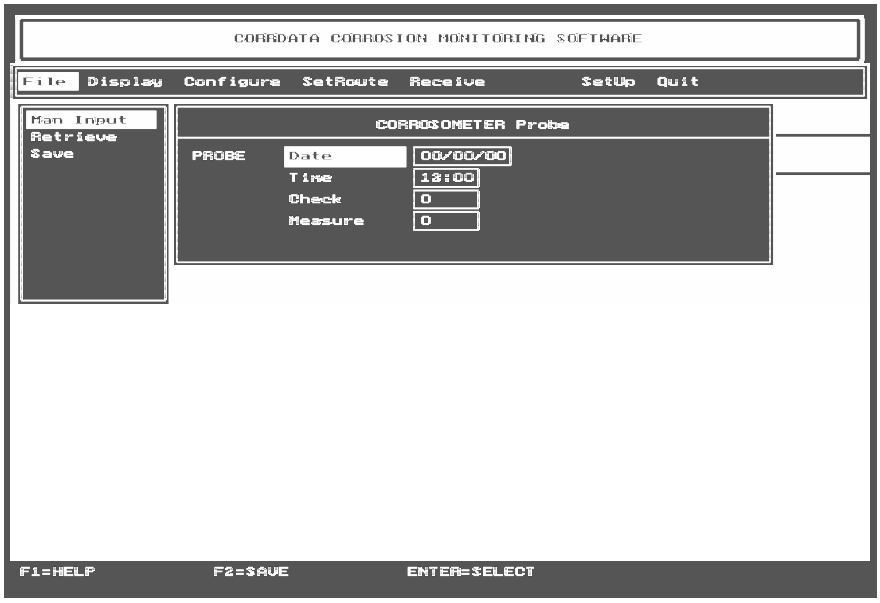
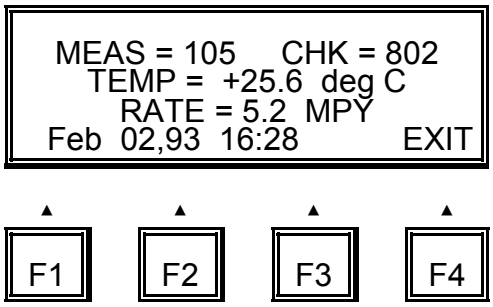


Figure 6.2 CORROSOMETER Probe Data Input Screen

Switch **ON** the CK4 and press **DISP** (F2), and select the probe label corresponding to probe selected on the P.C.



On the P.C. the input fields for a CORROSOMETER probe are **Date**, **Time**, **Check** reading, and **Measure** reading. On a CORROTEMP probe an additional data entry box for temperature will also appear. Use the ↑ and ↓ keys to select the required field, and the **Enter** key to enter and leave each data entry box. At initial entry the cursor is set to the overwrite mode as indicated by the thick cursor.

In the **Date** field enter the month, day, year from the CK4 screen in the numerical format indicated on the P.C. screen, including the / key between the month, day and year numbers. When complete press **Enter** again to leave that data entry box.

For the **Time** field, enter the time as indicated on the CK4 screen. This format is the 24 hour military format where 00:00 is midnight at the start of the day.

NOTE: *The **Time** entry box is set to a default of 12:00 mid-day. This may be left unchanged if the time of day that readings were taken is not critical. For example, some pipeline probe application may show low corrosion rates of a mil per year or similar. In this case, the variation of a few hours in the exact time that the probe is read has negligible effect.*

Enter the probe **Check** reading from the CK4 screen. The very first probe entry is the most critical as it is the one against which all the others will be compared, to determine if the check reading has gone bad. This is based on ± 20 divisions (or ±2.5% of span) from the initial reading, and is indicated by a thinner graph line than the normal for the segment of the graph following the bad check reading.

WARNING! ***Once the first reading has been saved with the F2 key the initial check reading cannot be reset without first deleting the probe in the** Configure **menu. This applies even if the** Edit **command is used to change the check reading as displayed.***

Enter the probe **Measure** reading from the CK4 screen. For a CORROSOMETER probe this will complete the list of probe entries.

For a CORROTEMP probe, the last entry is **Temperature**. Enter the **Temperature** reading from the CK4 screen in the same units of degrees centigrade. When satisfied with all the entries for that probe reading press **F2** to save the data.

NOTE: *At least two probe readings must be entered to be able to display a graph.*

From the manual probe list summary, or the individual probe data list, the graphical display may be viewed by the shortcut key **F3**. **Esc** will then return back to the same place. The full display features are available under **Display** on the main menu.

When one probe entry has been completed, press **Esc** to return to the manual probe summary list, and select the next probe for data entry. When all the probes have been completed press **Esc** as required to return to the main menu.

Probe data entries may be edited in the probe data entry screen within certain limits. First select the probe to be edited from the manual probe summary list, using the **Insert** key instead of the **Enter** key.

The date of a probe reading in the middle of a list may only be changed between the dates of the readings on either side of it. If the date is changed beyond this, the graph will "turn back" on itself when viewed.

NOTE: *The first and last probe readings in the list may not be deleted from this screen. If this is required, the whole probe must be deleted from the **Configure** menu.*

The first reading in the probe data is particularly important as it is used by the program as a the reference for the probe "check" against which all other "check" readings will be compared to indicate a bad reference element. Once this reading has been entered initially, even editing will not change the stored "check" reading even though it the reading on the data entry screen can be changed. If this initial reading is incorrect, delete the probe in the **Configure** mode and re-enter the data.

Archiving and Retrieving Old Data Files

The CORRDATA software provides for saving of files one at a time for archiving purposes, and for retrieving files for viewing one at a time. Any files saved are automatically given the extension .SAV to avoid overwriting the .DAT files if the CORRDATA directory is used. For archiving, sub-directories should be set up for the appropriate time periods (such as CD_MAR93) of the data. Each file can store up to 1131 sets of probe data points.

To save the current data to a sub-directory, first create the sub-directory in DOS at the required location before entering the CORRDATA program. Start the CORRDATA program and select **Save**, and press **Enter** to display the following screen.

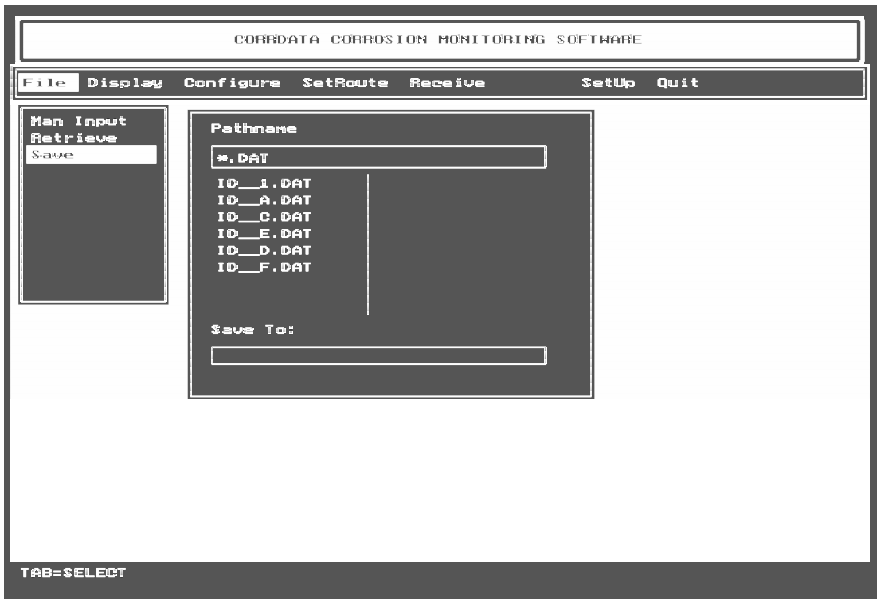


Figure 6.3 CORRDATA P.C. Software File Saving

The .DAT files are the data files in the current program directory. Press the **Tab** key to switch from the cursor in the pathname box to a highlight bar in the file list below. Use the ↑ or ↓ keys to make the required selection, and press the **Tab** key. This will display the selected file into the "Save to" box with the cursor and a .SAV file extension, and leave a gray highlight bar at the selected probe in the file box above. Modify the pathname as necessary for the destination sub-directory (such as c:\CORRDATA\MAR 93\ID_B.SAV)

already created in DOS. Press **Enter** to save the file, or use **Esc** to leave this screen without saving.

> ***NOTE:*** *In the CORRDATA software, data files can only be saved to an archive directory one at a time.*

Archived data files may also be retrieved for the full viewing and analysis capability of the CORRDATA program via the **Display** menu. Only one data file at a time may be viewed from the archive files. Exiting the **View** or **Range** on the **Display** sub-menu to **List** or back to the main menu will automatically cancel the archived data file selection. However range zooming and rate calculations on graphs are fully operational on the retrieved file before exiting as described.

> ***NOTE:*** *A retrieved file is never added to the probe list in the current CORRDATA program directory. This may only be achieved by changing the filename outside the program to an unused ID number, installing the file in the CORRDATA program directory, and then selecting this ID number through the* ***NEW*** *entry screen in the* ***Configure*** *mode, and* ***View*** *in the display mode.*

To Retrieve an archived file, select **File** from the main menu, and **Retrieve** from the sub-menu. The box that appears will show a pathname box with a cursor present, and a blank file box. Modify the pathname as required to select the required directory and files using wildcards and extensions as convenient to simplify the displayed list of files (example: C:\CORRDATA\CD_MAR93*.SAV). This will produce a display similar to the following.

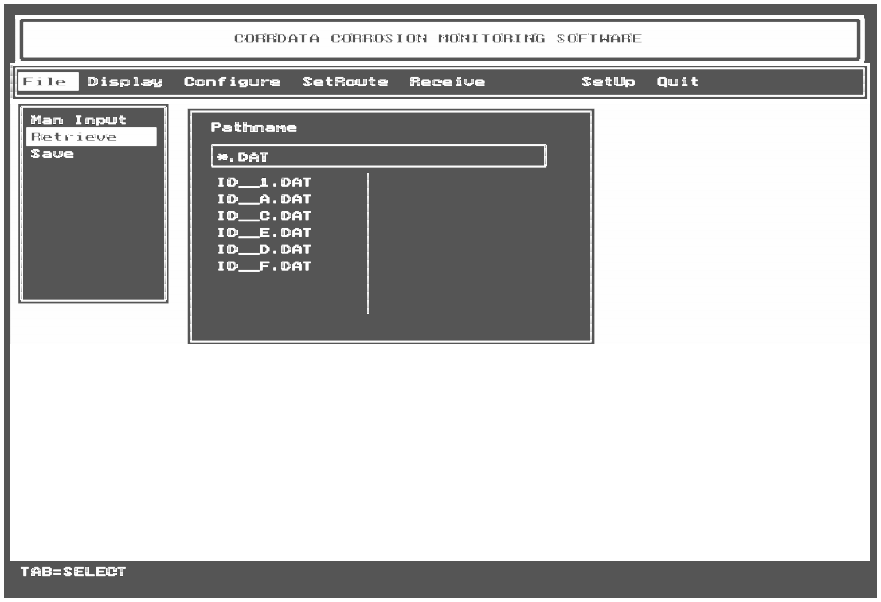


Figure 6.4 CORRDATA P.C. Software File Retrieval

Press **Tab** to switch from the pathname box to a highlight bar in the file list box. Use the ↑ or ↓ arrows to select the required RDC and press **Enter**. Press **Display** and **View** to display the graph. The graph may be zoomed as required, and corrosion rates displayed with the cursor keys and **Enter**. To return to the current operating probe list, press **Esc** and **List**.

Chapter 7
Corrosion Data Analysis

In the CORRDATA software package the corrosion data may be viewed one probe at a time in a graphical format which is generally the most useful to interpret corrosion events and trends.

Once data has been collected by the CK4 and transferred to the P.C., the CORRDATA software program is ready to display that data.

It should be made clear here that CORROSOMETER and CORROTEMP probes directly measure metal loss rather than corrosion rate. A single reading from a CORROSOMETER or CORROTEMP probe cannot give the corrosion rate at that time. The metal loss over some finite period of time must be used to calculate corrosion rate.

In a sense the CORROSOMETER and CORROTEMP probe metal loss measurements can be likened to an automobile odometer or mileometer. The corrosion rate, on the other hand, can be likened to the speedometer.

For a CORROSOMETER or CORROTEMP probe, the "current corrosion rate" must actually be calculated on the metal loss occurring over some finite period of time, normally ranging from a few hours to a few days. Hence for the CORROSOMETER or CORROTEMP probe corrosion rate is always a calculated number.

The CORRDATA system can be extended with Remote Data Collectors (RDC's) and either a CORRDATA Mate I or Mate II to automatically collect corrosion data. The advantage of RDC's is to provide much higher frequency of measurements and a much improved resolution of corrosion dynamics. The graphical display of RDC generated data is similar to data generated by individual probe readings, in that straight lines are drawn between the individual readings. The only difference between the two types of data is that data points from direct probe measurements are identified with small circles around each point.

> ***NOTE:*** *An example of the type of data from such an RDC system may be viewed by retrieving the* ***DEMO.SAV*** *file through the file retrieve sequence.*

Displaying CORROSOMETER and CORROTEMP Metal Loss Data

To display any of the current CORROSOMETER or CORROTEMP metal loss data, it is first necessary to select the sub-directory containing the CORRDATA program and type the command **CK**.

> ***NOTE:*** *Selection of the sub-directory CORRDATA and issuing of the command **CK** may be incorporated into your PC shell or menu to give direct entry to the CORRDATA program.*

Select **Display** from the main menu and then **List** from the sub-menu to display the current probe list. A probe list summary of all the probes on the system will be added to the screen.

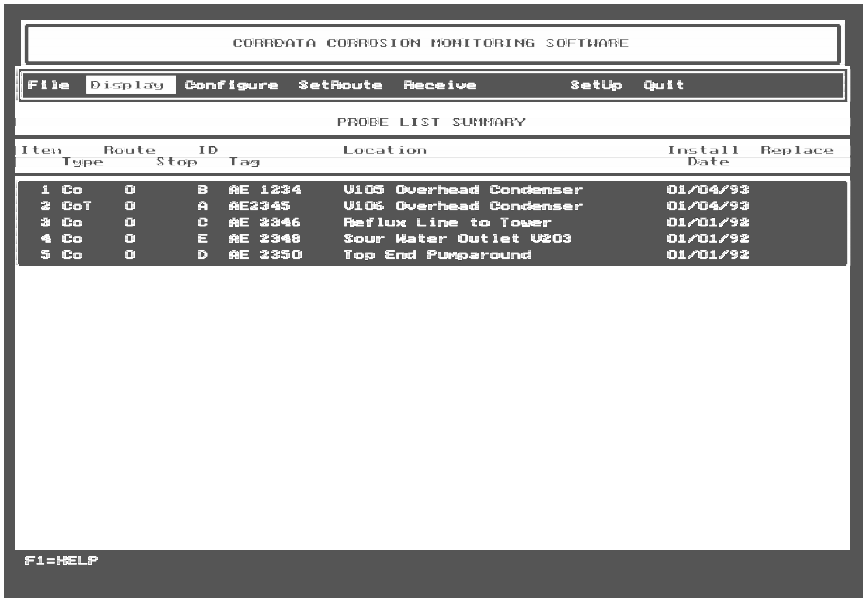

CORRDATA CORROSION MONITORING SOFTWARE
File Display Configure SetRoute Receive SetUp Quit
PROBE LIST SUMMARY
Item Route ID Location Install Replace
Type Stop Tag Date
1 Co 0 B AE 1234 V105 Overhead Condenser 01/04/93
2 CoT 0 A AE2345 V106 Overhead Condenser 01/04/93
3 Co 0 C AE 2346 Reflux Line to Tower 01/01/92
4 Co 0 E AE 2348 Sour Water Outlet V203 01/01/92
5 Co 0 D AE 2350 Top End Pumparound 01/01/92
F1=HELP

Figure 7.1 Probe Display Selection

> ***NOTE:*** *Many of the selections in this menu are dimmed (or barely visible). These additional features are for future developments in integrated corrosion measurements.*

Use the ↑ or ↓ keys to select the required CORROSOMETER or CORROTEMP probes. Press **Esc** to return to the display sub-menu, and **View** to display a metal loss against time graph such as the following.

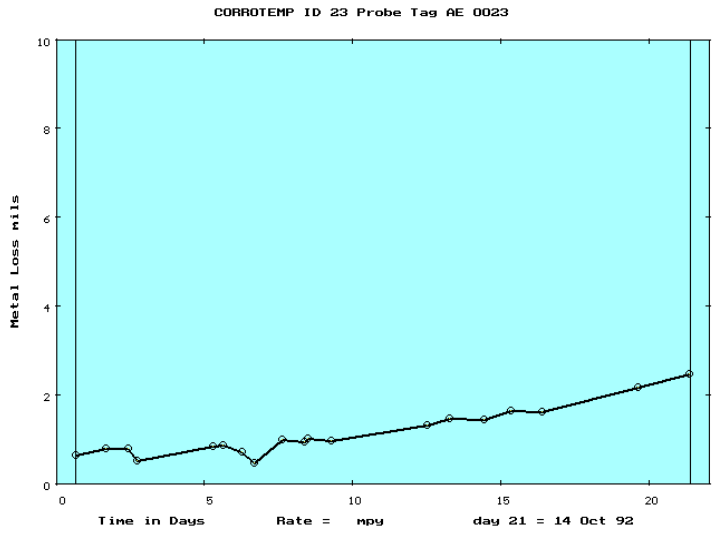


Figure 7.2 CORROSOMETER or CORROTEMP Probe Metal Loss Graph.

> ***NOTE:*** *If a probe has not been selected from the probe list or no probe data has been collected for the selected probe, a blank graph will briefly appear and then disappear when view is selected.*

Initially the y-axis of the graph is scaled to the full span of the probe life e.g. a T10 probe has a 5 mil span, a T20 has a 10 mil span (see Figure 5.5) and the x-axis has a time period corresponding to the period of data collected, up to a maximum of 1,131 readings. The last recorded probe data is on the right hand side of the screen.

Data older than the 1,131 points is discarded as new data is added. To keep data older than this, save the data to a separate file as described in Chapter 6 "Archiving and Retrieving Old Data Files".

On the X-axis the scale is identified in days. The date of the last recorded reading is shown on the bottom of the graph (for example, on the above graph the last data was recorded on 8 Feb, 1993, where 8 Feb is from day 34.0 to 35.0. The first day is from 0.0 to 1.0). The dates corresponding to the cursors may be displayed by pressing the **Enter** key at any time.

Editing and Analyzing Metal Loss Graphs.

Select the required portion of the graph with the vertical cursors. To adjust the cursor for this purpose, use the → or ← arrow keys to move the cursor, and the **Space bar** to switch between the two cursors.

> ***NOTE:*** *Initially the cursor lines are on the sides of the graph and may not be readily visible. The selected cursor at entry to the screen is the left hand line.*

Once the desired selection has been made press **Enter**. The corrosion rate will be calculated and displayed at the bottom of the screen along with the start and finish dates corresponding to the cursors. The corrosion rate is determined by the statistical method of Linear Regression (i.e. the slope of the best straight line through the selected data)

> ***WARNING!*** ***No corrosion rate is displayed in this box until one or other of the cursor lines has been moved, and the*** *Enter* ***key pressed.***

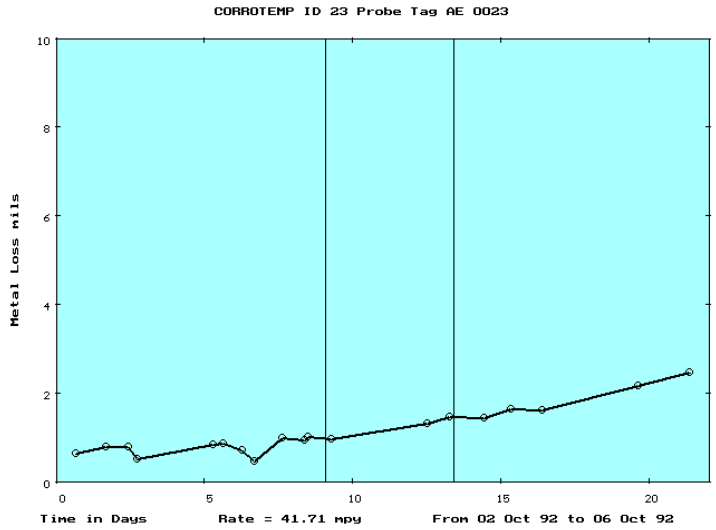


Figure 7.3 Metal Loss Graph with Rate Display

To zoom in on the corrosion data graph press **Esc** to return to the display sub-menu and select **Ranges**. Choose either the **X-Select** or **Y-Select** as required. If the **Y-Select** is chosen the graph will reappear with two horizontal cursors lines at the top and bottom of the graph.

Use the ↑ or ↓ keys to move the cursor lines, and the **Space bar** to toggle between the two cursors as shown in Figure 7.4. When you are satisfied with the selection press **Esc**.

If you also wish to zoom in on the X-axis choose the **X-Select**. The graph will reappear with the X range zoomed in. Use the ← or → keys to move the cursor lines and the **Space bar** to toggle between cursors, and to select the required range. Press **Esc** twice and **View** to display the zoomed in graph.

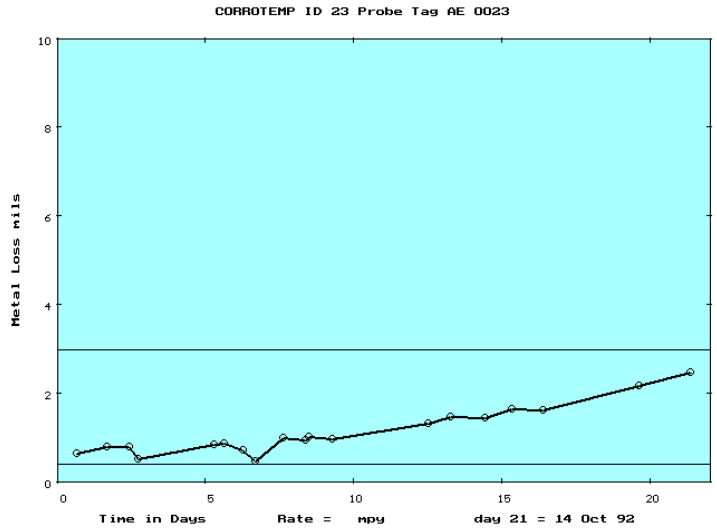


Figure 7.4 Selecting Y-range

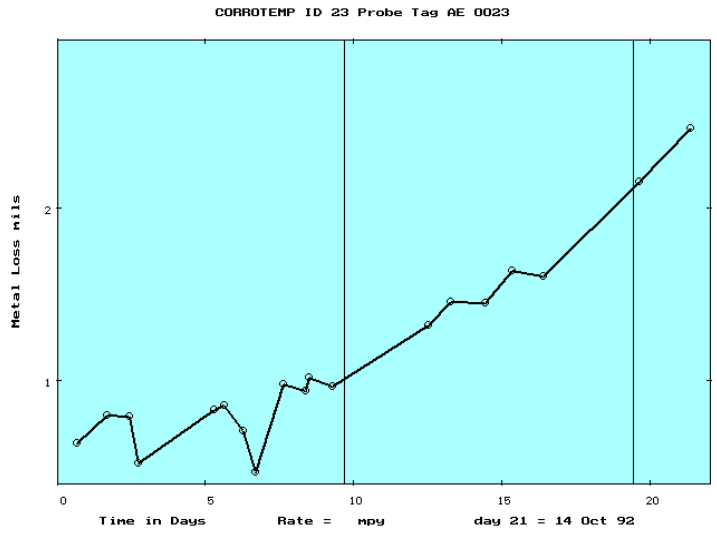


Figure 7.5 Selecting X-Range

Re-entering **Ranges** on the display sub-menu will cause the X and Y axes to return to the fully zoomed out ranges ready for the next selection.
The metal loss graph line will normally be thick for most or all of the graph (2 pixels wide) but may be thinner near the end of probe life (1 pixel). This is determined by the condition of the CORROSOMETER or CORROTEMP probe check reading. The probe check reading should remain constant within ± 2.5% of probe span. If it does not, it indicates possible damage to the probes internal reference element. A bad check reading condition is recorded along with the metal loss and causes the graph to change to a thin line.

The thin graph line indicates that this part of the metal loss graph may be suspect, and that the probe should be replaced. Corrosion occurring on the reference element will generally cause a decrease in the recorded metal loss.

Displaying Temperature on CORROTEMP Probes

CORROTEMP probes are CORROSOMETER probes with an added temperature sensing device. To display the temperature graph, select the CORROTEMP probe from the probe **List** in the normal way. Use the "**T**" key to toggle between graphs of metal loss and temperature.

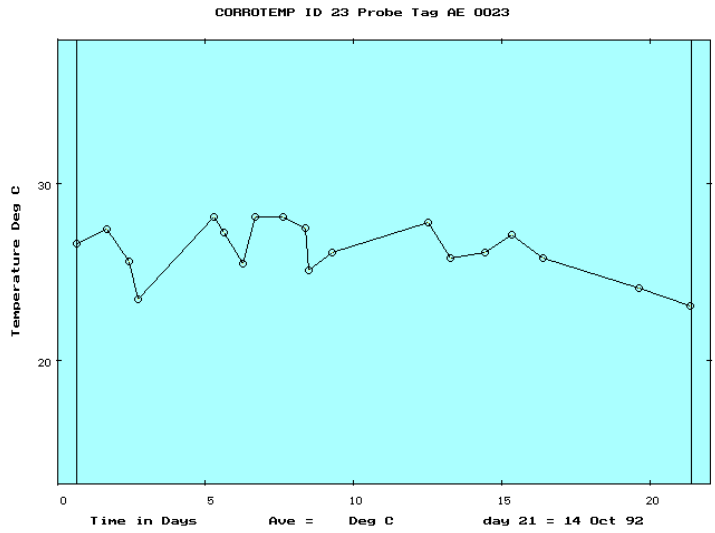


Figure 7.6 CORROTEMP Probe temperature graph

The temperature graph may be zoomed in the same way as the metal loss graph. For convenience, the X-axes of the two graphs zoom together to display the same time period of data. The Y-axes of the two graphs are independent.

> ***NOTE:*** *Only one graph of metal loss or temperature may be zoomed in on at a time.*

The average temperature measurement may be computed automatically over a period of time by using the vertical cursors to select the desired time span and pressing **Enter**.

Printing from CORRDATA Software

To print from the CORRDATA software it is necessary to load an MS DOS graphics file BEFORE loading the CORRDATA program, since there is no integral graphics printing in the program. Recent MS DOS operating systems have screen graphics printing capability from the **Shift + Print Screen** key.

For MS DOS 4.01, it is necessary to have typed "graphics" at the DOS prompt, before running the CORRDATA software. This will be suitable for most dot matrix printers. However it does not serve laser or inkjet printers.

> ***NOTE:*** *The graphics file may already be running if it is loaded as part of your AUTOEXEC.BAT.*

Print screen is then initiated by **Shift + Print Screen**. Only a limited range of printers are supported. See MS DOS manual "Graphics" for more detail.

With MS DOS 5.0 a larger range of printers are supported with the graphics command including laser jet, paintjet, and deskjet printers.

For the common printers listed below type the command shown at the DOS prompt before entering the CORRDATA program.

IBM Proprinter	graphics/r
HP Laserjet	graphics laserjet/r
HP Laserjet II	graphics laserjetii/r
HP Deskjet	graphics deskjet/r

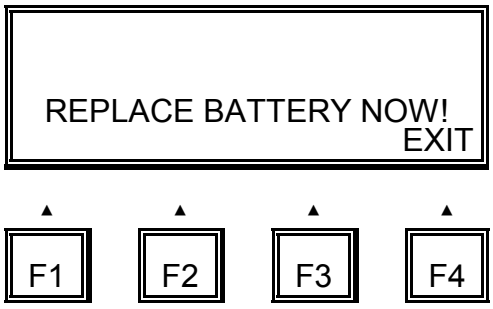
The print screen is again initiated by **Shift + Print Screen**. For more detailed instructions see the MS DOS 5.0 reference manual.

Chapter 8
Maintenance

CK4 Instrument

The general requirements for maintenance on these units are battery change-out, general care and cleanliness of the unit, and occasional inspection of the connectors for damage.

The CK4 operates from six AA battery cells. The use of alkaline batteries is recommended which will give an average continuous operating time of 8 hours. The batteries are checked under load conditions both when the unit is first switched on and during the probe measurement sequence. If low batteries are detected the following screen will be displayed.



The CK4 has a small lithium battery back up on an internal circuit board with an anticipated life of 7 - 10 years. The unit must be returned to Rohrback Cosasco or its authorized representative for replacement of this battery.

P.C. CORRDATA Software

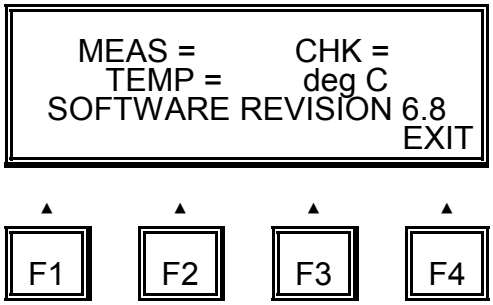
This requires no maintenance. If any problems occur contact the factory for assistance.

Software Revisions

The revision level of the P.C. software can be checked from the part number on the system diskettes, and the date of the main CK.EXE file.

The revision level of the CK4 may be checked as follows:

Switch **ON** the instrument. Select **DISP** (F2) from the start up screen, and then press **F1**.



The third line of the display shows the revision level. The software is programmed in ROM (Read Only Memory). Any revisions require installation of a re-programmed chip, which must be done by Rohrback Cosasco Systems.

Chapter 9
Troubleshooting

Checking CK4 Instrument

Trouble-shooting on the CK4 is very basic and simple. A test probe with specified measure, check, and temperature readings is provided which may be read by the CK4. The readings should be within the limits given on the test probe. If they are not then the unit should be returned to Rohrback Cosasco Systems for repair. There are no user adjustments on the instrument.

P.C. Software

If the CORRDATA program does not start up on your computer, check the specification of your system meets the requirements listed in Chapter 2 of the manual.

If any part of the program does not work correctly, it may be the result of a corrupted program file. If this occurs, re-install the CORRDATA program from the diskettes supplied. This will not affect any probe data that has been collected, or the probe list file.

If Problems Still Occur

If problems still occur, contact the factory for assistance.

Appendix A

Theory of Operation of CORROSOMETER Systems

CORROSOMETER Systems are based on the electrical resistance method of corrosion monitoring pioneered by Rohrback in the 1950's and 1960's. CORROSOMETER probes are basically "electrical coupons." They determine the loss of metal from the probe by measuring the change in its resistance. Because of the very low resistances involved, very sensitive monitoring circuits are used in CORROSOMETER instruments to measure the change in probe resistance compared to a protected reference element resistance series-connected to the corroding measurement element. A "check" element is also included and is protected from the process along with the reference element. The ratio of check to reference resistance should remain constant. If it doesn't, this indicates that degradation of the reference element may be occurring and that metal loss readings obtained from the probe are questionable. A simplified diagram of a typical electrical resistance monitoring circuit is shown in Figure 1.

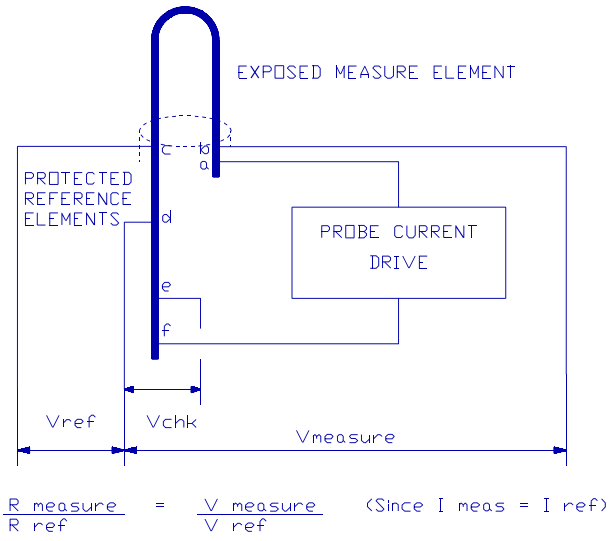


FIGURE 1

As with coupons, CORROSOMETER probes must be allowed to corrode for a period of time before accurate corrosion rate measurements can be made. The actual length of time required depends upon the corrosion rate--the higher the rate, the shorter the time required, and vice-versa. CORROSOMETER probes are available in a variety of styles and with useful probe life ("span") ranging from 2-25 mils, in styles commonly used in process piping systems. Instrumentation to measure electrical resistance probes divides the probe span into l000 "divisions." A probe with a 2 mil span is therefore theoretically capable of measuring thickness changes of 0.002 mils. In practice, however, we recommend that a change in indicated metal loss of l0 divisions be required before the data are used to calculate corrosion rate. Indications of an upward or downward trend can be obtained with as little as a 4-division change, but care must be exercised in interpreting such small changes because other factors (e.g. temperature changes) can also be responsible. The actual time required to produce meaningful corrosion rate information with common probe spans at different corrosion rates is shown in Figure 2 and summarized in Table 1.

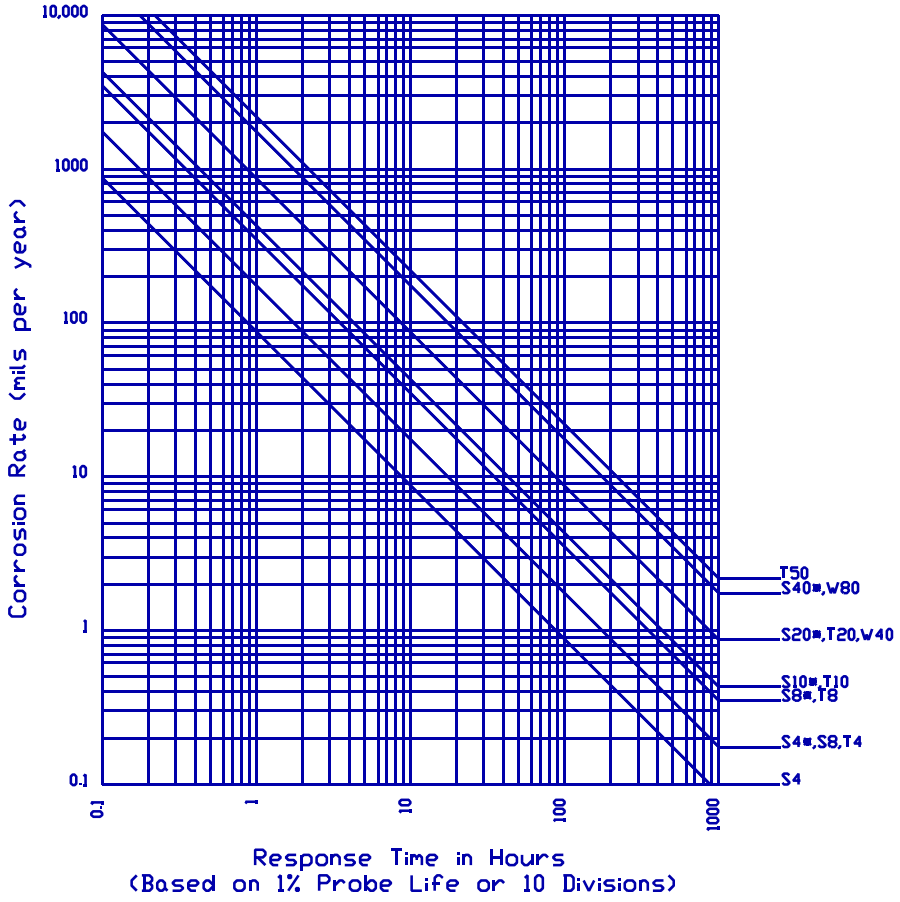


FIGURE 2

Corrosion Rate (mpy)	Probe Span (mils)					
	2	4	5	10	20	25
0.1	73 days	5 months	6 months	12 months	24 months	30 months
0.5	15 days	29 days	37 days	73 days	5 months	6 months
1.0	7 days	15 days	18 days	36 days	73 days	3 months
5.0	35 hours	3 days	4 days	7 days	15 days	18 days
10	18 hours	35 hours	2 days	4 days	7 days	9 days
25	7 hours	14 hours	18 hours	35 hours	3 days	4 days
50	4 hours	7 hours	9 hours	18 hours	35 hours	2 days
75	140 mins	5 hours	6 hours	12 hours	23 hours	29 hours
100	105 mins	4 hours	5 hours	9 hours	18 hours	22 hours

TABLE 1

Elapsed Time* To:			Corrosion Rate* with 10 mil Span Probe
Early Trend Indication (4 Div.)	Meaningful Rate Data (10 Div.)	End of Useful Probe Life (1000 Div.)	
1.6 hours	4.0 hours	17 days	220 mpy (5.6 mm/y)
4.0 hours	10.0 hours	1.4 months	88 mpy (2.2 mm/y)
9.6 hours	1 day	3.3 months	37 mpy (0.94 mm/y)
18.0 hours	1.8 days	6.0 months	20 mpy (0.51 mm/y)
1.1 days	2.7 days	9.0 months	13 mpy (0.33 mm/y)
1.5 days	3.7 days	12.0 months	10 mpy (0.25 mm/y)
1.8 days	4.6 days	15.0 months	8 mpy (0.20 mm/y)
2.2 days	5.5 days	18.0 months	6.7 mpy (0.17 mm/y)
2.9 days	7.3 days	24.0 months	5 mpy (0.13 mm/y)

* All data shown to two significant digits only.

TABLE 2

From Table 1, it would appear desirable to always choose probes with the lowest span available in order to get the greatest sensitivity. However, the more sensitive the probe, the faster the entire probe span will corrode away and require a new probe to be installed.
Table 2 illustrates this relationship.

It is our experience that the objectives of most monitoring programs can be achieved cost-efficiently by selecting CORROSOMETER probes which will reach the end of their useful life in 6 - 9 months at the expected corrosion rate. Unlike a monthly coupon replacement program, this electrical resistance probe will continuously produce data that verifies that the average corrosion rate over the previous 2-3 days is still at the originally-expected (design) rate. If the corrosion rate increases to twice the design rate, meaningful data to permit the new rate to be calculated will be available in a day and a half. Conversely, if the actual corrosion rate is below design, a longer period is required before meaningful data are available to calculate the new rate.

CORROSOMETER probe elements are available in a variety of styles. A selection of the available styles is shown in Figure 3. Wire, tube, and strip-loop styles all have a loop of metal exposed to the process. The loop protrudes from the end of the probe body through either a hermetic glass seal or a Teflon/ceramic, Teflon/epoxy or epoxy seal/packing system. Choice of materials is dependent upon stream composition, process conditions and performance requirements. Cylindrical elements utilize specially-made, thin-wall tubing as the measurement element. Cylindrical probes are generally "all-metal;" i.e., there is no other material exposed to the process. There are, however, also some cylindrical probes available which join the probe body at a hermetic glass seal. A variety of flush-mounted probes are also available; so-called because the measuring element is mounted parallel to the flow stream, flush with the inside pipe wall.

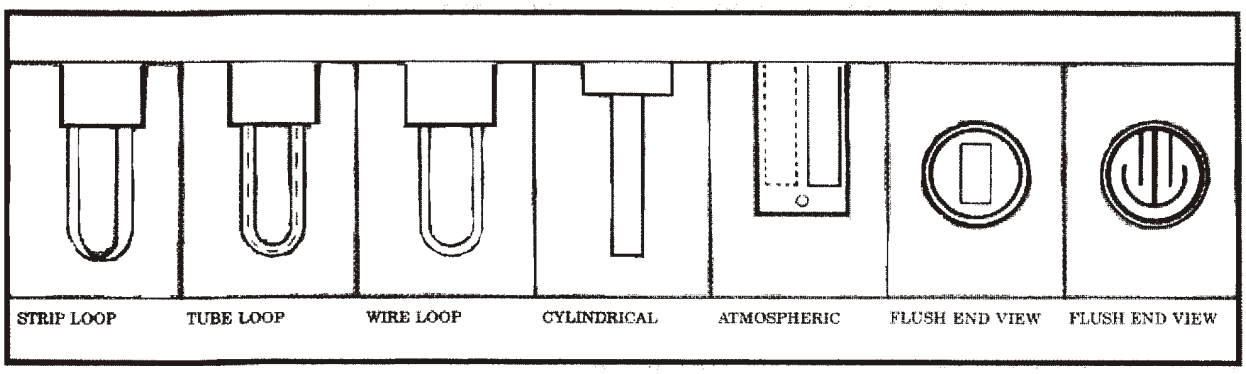


FIGURE 3

CORROSOMETER monitoring systems can be applied to all processes. However, some types of CORROSOMETER probes are better suited to the requirements of particular applications than others.

Different styles of CORROSOMETER probes are affected to different degrees by pitting attack. Figure 4 shows the results of pitting attack on a wire loop probe. Although the remaining wire thickness shows that only 30% or so of the probe span has been consumed, the probe is obviously out of service. Cylindrical elements on the other hand, are affected to a much lesser degree by pitting because of the much larger circumference of the measuring element. Wire loop and tube loop elements also have a tendency to be electrically shorted by a bridge of iron sulfide corrosion product. This is especially prevalent in low-velocity streams over an extended period. The effect of such bridging is to reduce the measured metal loss of the probe, creating a misleadingly low corrosion rate. Cylindrical probes demonstrate more resistance to iron-sulfide bridging due to their construction and lower inherent resistance per unit length, thus minimizing the effect of the shunt resistance. Where pitting or substantial Fe_xS_y deposition are expected to be problems, cylindrical probes should be chosen wherever possible over loop-style probes.

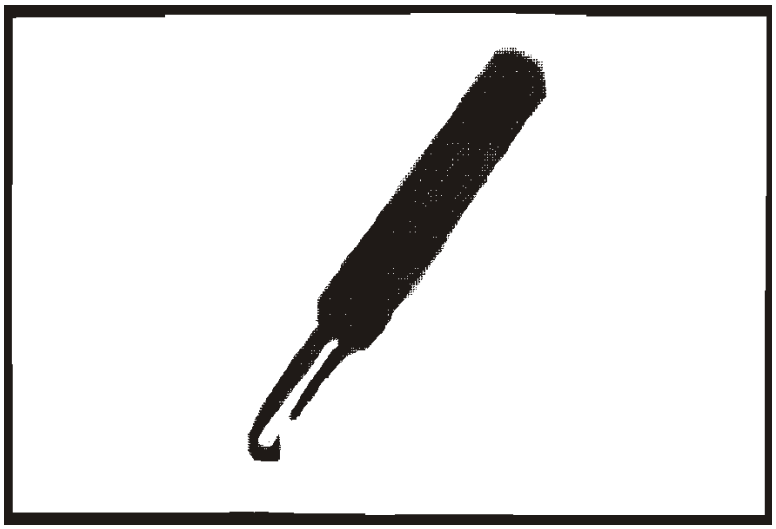


FIGURE 4

Most cylindrical probes are of all-welded construction in order to eliminate the need for sealing metal elements to non-metallic glass, epoxy or ceramic. This all-welded construction gives the probe superior resistance to leaking. Probes with higher temperature ratings can also be constructed in the all-welded style. A drawback to the all-welded style is that the element is electrically connected to the pipe wall which can, in certain conditions, interfere with the corrosion reaction on the probe. Also, because cylindrical probes are welded, in some conditions preferential corrosion can occur in the heat-affected zones near the weld.

Flush probe elements are thin, flat metal sections embedded in epoxy or a hermetic glass seal inside a metal probe body. Flush probes also experience certain characteristic problems, most notably: lack of adhesion of the metal element to the epoxy, cracking of glass seals due to differential expansion and erosion of the epoxy or glass due to high velocities, abrasive materials in the flowstream or both. Flush CORROSOMETER probes mounted on the bottom of the line have been shown to provide good results in a sour gas gathering system.

Because the measurement element is part of the primary pressure seal, and because it's designed to corrode, CORROSOMETER probes have a reduced resistance to leaking after prolonged exposure. Once the measurement element has corroded through, the internals of the probe body are exposed to the process fluid. Although materials are chosen in part for their strength and lack of permeability, it is our experience that process fluids will permeate throughout the probe packing material. For this reason, quality probes are constructed of corrosion-resistant body materials and include a secondary pressure seal, often consisting of a hermetic glass-sealed connector. Other back-up seals are utilized in special cases, especially where process fluids will attack glass (e.g. hydrofluoric acid service). Please contact the factory if you have any questions about the compatibility of probe materials with your application.

The reference and check elements are protected from the process to which the measurement element is directly exposed. Temperature changes in the process will, therefore, affect the measure element before the reference and check elements. Because of the very low resistances involved, these changes can significantly affect the metal loss readings. CORROSOMETER probes incorporate special design features to minimize the thermal resistance of the materials insulating the reference and check elements from the process. It should also be noted that cylindrical probes are inherently better able to react to temperature changes due to location of the reference and check elements concentrically inside the measure element.

Appendix B

Special Conditions or Limitations for use of Intrinsically Safe Equipment to European Harmonized Standards

BASEEFA Certifications of the CORRDATA system to the harmonized European standard for intrinsic safety are included in this Appendix.

a) BAS No Ex 92C2417 CORRDATA Mate, CORRDATA Mate II (14 pages)
b) BAS No EX 90C2388X Range of CORROSOMETER Probes (8 pages)

The conditions set out in these documents must be followed to ensure that the certifications are valid.

BASEEFA

British Approvals Service for Electrical Equipment in Flammable Atmospheres

1. CERTIFICATE OF CONFORMITY

2. BAS No Ex 92C2417

3. This certificate is issued for the electrical apparatus:

DATA LOGGER MODEL HT/1121E-RC

4. manufactured and submitted for certification by:

TERMIFLEX CORPORATION

of 316 Daniel Webster Highway, Merrimack, NH, 03054, USA

5. This electrical apparatus and any acceptable variation thereto is specified in the Schedule to this Certificate and the documents therein referred to.

6. BASEEFA being an Approved Certification Body in accordance with Article 14 of the Council Directive of the European Communities of 18 December 1975 (76/117/EEC) certifies that the apparatus has been found to comply with harmonised European Standards

EN 50 014 (1977) + Amendments 1 to 5
EN 50 020 (1977) + Amendments 1 and 2

and has successfully met the examination and test requirements as recorded in confidential Report No ERA Ref 3627/575, dated November 1992

7. The apparatus marking shall include the code

EEx ia IIC T4
(Tamb = 50°C)

File No: EECS 2997/02/001

Sheet 1/6

3905/51-C

ELECTRICAL EQUIPMENT EECS CERTIFICATION SERVICE

PP **I M CLEARE**
DIRECTOR EECS
20 November 1992

Electrical Equipment Certification Service
Health and Safety Executive
Harpur Hill, Buxton, Derbyshire, SK17 9JN, United Kingdom
Tel: 0298 26211 Fax: 0298 79514 Telex: 668113 RLSD G

HSE Health & Safety Executive

BASEEFA

British Approvals Service for Electrical Equipment in Flammable Atmospheres

Certificate BAS No Ex 92C2417 dated 20 November 1992

8. The manufacturer of the electrical apparatus referred to in this certificate, has the responsibility to ensure that the apparatus conforms to the specification laid down in the Schedule to this certificate and has satisfied routine verifications and tests specified therein.

9. This apparatus may be marked with the Distinctive Community Mark specified in Annex II to the Commission Directive of 16 January 1984 (Doc 84/47/EEC). A facsimile of this mark is printed on sheet 1 of this certificate.

This certificate is granted subject to conditions applicable to the Approval Service, it does not necessarily indicate that the apparatus may lawfully be used in particular industries or circumstances.

ELECTRICAL EQUIPMENT EECS CERTIFICATION SERVICE

Electrical Equipment Certification Service
Health and Safety Executive
Harpur Hill, Buxton, Derbyshire, SK17 9JN, United Kingdom
Tel: 0298 26211 Fax: 0298 79514 Telex: 668113 RLSD G

HSE Health & Safety Executive

Schedule

Certificate of Conformity BAS No Ex 92C2417 dated 20 November 1992

APPARATUS

A DATA LOGGER MODEL HT/1121E-RC is a portable battery operated unit designed to collect data from a Corrosometer RDC-CO or Corrator RDC-CA Remote Data Collector, Certificate BAS No Ex 92C2435, Coded EEx ia IIC T3 (Tamb = 70°C) or T4 (Tamb = 50°C) or Corrosometer Probes, Certificate BAS No Ex 90C2388X, Coded EEx ia IIC T4.

The stored information may only be transferred in the non-hazardous area to a personal computer via an Isolator Cable 723031, part of Certificate BAS No Ex 92C2435.

The data logger comprises electronic circuits on two printed circuit boards with a membrane keyboard and a liquid crystal display all housed in a plastics enclosure which provides a Degree of Protection of at least IP20.

The data logger is powered by six alkaline batteries type IEC LR6.

The batteries must only be changed in the non-hazardous area.

Intrinsic safety is assured by limitation of capacitance, infallible current limiting resistors, internal limitation of voltage and infallible segregation.

The intrinsically safe parameters at the communication socket are:

Pins 2 & 3 to pin 1

$U_{max:out}$ = 10.9 V dc
$I_{max:out}$ = 23 mA dc
$W_{max:out}$ = 63 mW

$U_{max:in}$ = 10.9 V dc
$W_{max:in}$ = 0.3 W

Pins 4 to 15 inclusive

$U_{max:out}$ = ± 6.0 V
$I_{max:out}$ = 0.55 A
$W_{max:out}$ = 1.1 W

Connection only to Corrosometer Probes
Certificate BAS No Ex 90C2388X

Schedule

Certificate of Conformity BAS No Ex 92C2417 dated 20 November 1992

DRAWINGS

Number	Issue	Date	Description
99-0597-0000 Shts 1 & 2	A	9.10.92	General Assembly
BOM 99-0597-0002 Shts 1 & 2	B	11.9.92	BOM, Termiflex with Aux Board
97-0395-0001	A	9.10.92	Cable Assy, Main & Aux Boards
BOM 97-0395-0001 Shts 1 & 2	B	9.24.92	BOM
97-0395-0002	A	9.10.92	Cable Assy, Main Board
BOM 97-0395-0002 Shts 1 & 2	B	9.24.92	BOM
SCD 52-0133-0015 Shts 1 to 4	A	9.10.92	Connector
A1719 Shts 1 to 10	E	9.24.92	Keyboard
SCD58-2043-0000 Shts 1 to 4	E	9.10.92	Display
98-0140-0000 Shts 1 & 2	C	9.10.92	PCB Assy HT/1121E
98-0140-0000 Shts 1 & 2	D	11.9.92	PCB Assy HT/1121E
BOM 98-0140-0000 Shts 1 & 2	E	11.9.92	BOM
BOM 89-0140-0000 Shts 1 & 2	E1	11.11.92	BOM
BOM 89-0140-0000 Shts 1 & 2	F	11.11.92	BOM

Schedule

Certificate of Conformity BAS No Ex 92C2417 dated 20 November 1992

Number	Issue	Date	Description
34-0140-0000	D	9.10.92	PCB Drill HT/1120E
34-0140-0000	E	11.9.92	PCB Drill HT/1120E
65-0140-0000 Shts 1 to 14	B	8.14.92	PCB HT/1120E Artwork
65-0140-0000 Shts 1 to 14	C	11.9.92	PCB HT/1120E Artwork
33-0140-0000 Shts 1 & 2	D1	11.9.92	HT/1120E Schematic
33-0140-0000 Shts 1 & 2	E	11.11.92	HT/1120E Schematic
SCD 62-0002-0000 Shts 1 to 3	C	9.10.92	Piezo Alarm
98-0139-0000	D	9.10.92	PCB Assy RCS BD2
BOM 98-0139-0000 Shts 1 to 3	E	9.10.92	BOM
34-0139-0000	D	9.10.92	PCB Drill RCS BD2
65-0139-0000 Shts 1 to 14	C	8.26.92	PCB RCS BD2 Artwork
33-0139-0000 Shts 1 & 2	F	9.10.92	RCS BD2 Schematic
SCD 54-0589-0001 Shts 1 & 2	B	9.10.92	Transformer
53-0010-0200	C	9.10.92	Inductor
BOM 53-0010-0200 Shts 1 & 2	B	9.10.92	BOM
70-0058-0002	B	11.9.92	Label (Termiflex)

Schedule

Certificate of Conformity BAS No Ex 92C2417 dated 20 November 1992

VARIATION ONE

To permit the removal of the auxiliary printed circuit board thus forming a DATA LOGGER MODEL HT/1121E

DRAWING

Number	Issue	Date	Description
BOM 99-0597-0005 Shts 1 & 2	B	11.9.92	BOM, Termiflex, W/O Aux Board

VARIATION TWO

To permit DATALOGGER MODELS HT/1121E-RC and HT/1121E to be designated CORRDATAMATE II and CORRDATAMATE respectively when affixed with Trade Agent labels.

DRAWINGS

Number	Issue	Date	Description
~~BOM 99-0589-0002~~ Shts 1 & 2	D	11.9.92	BOM, Rohrback with Aux Board
~~BOM 99-0589-0005~~ Shts 1 & 2	B	11.9.92	BOM, Rohrback with Aux Board
70-0058-0003	A	9.9.92	Label (Rohrback)

British Approvals Service for Electrical
Equipment in Flammable Atmospheres

CERTIFICATE OF CONFORMITY VARIATION

THIS IS TO CERTIFY THAT CERTIFICATE BAS No Ex 92C2417

Held by TERMIFLEX CORPORATION

of 316 Daniel Webster Highway, Merrimack, NH, 03054, USA

for the DATA LOGGER MODEL HT/1121E-RC

is hereby extended to apply to apparatus designed and constructed in accordance with the specification set out in the Schedule of the said Certificate but having the variations specified in the attached Schedule.

A copy of this Supplementary Certificate shall be attached to the original certificate.

File No: EECS 2997/02/001

ERA Ref: 3627/649

CERTIFICATE BAS No Ex 92C2417/1
4183/12-B

I M CLEARE
DIRECTOR EECS
26 March 1993

Electrical Equipment Certification Service
Health and Safety Executive
Harpur Hill, Buxton, Derbyshire, SK17 9JN, United Kingdom
Tel: 0298 26211 Fax: 0298 79514 Telex: 668113 RLSD G

Schedule

Certificate of Conformity BAS No Ex 92C2417/1 dated 26 March 1993

VARIATION THREE

To permit minor mechanical and circuit changes.

DRAWINGS

Number	Issue	Date	Description
99-0597-0000 Shts 1 & 2	C	3.18.93	General Assembly
BOM 99-0597-0002 Shts 1 & 2	C	3.9.93	BOM Termiflex with Aux Board
BOM 99-0597-0005 Shts 1 & 2	C	3.9.93	BOM Termiflex w/o Aux Board
BOM 99-0589-0002 Shts 1 & 2	E	3.9.93	BOM Rohrback with Aux Board
BOM 99-0589-0005 Shts 1 & 2	C	3.9.93	BOM Rohrback w/o Aux Board
97-0395-0001	C	3.18.93	Cable Assy, Main & Aux Boards
BOM 97-0395-0001 Shts 1 & 2	D	3.18.93	BOM
97-0395-0002	C	3.18.93	Cable Assy, Main Board
BOM 97-0395-0002 Shts 1 & 2	D	3.18.93	BOM
SCD 97-0400-0000 Shts 1 to 3	A	3.9.93	Cable
A1719 Shts 1 to 10	F	3.8.93	Keyboard
BOM 98-0140-0000 Shts 1 & 2	F	3.9.93	BOM, PCB Assy HT/1121E BD1
BOM 89-0140-0000 Shts 1 & 2	G	3.9.93	BOM, PCB Assy HT/1121E BD1
98-0139-0000	E	3.8.93	PCB Assy RCS BD2
BOM 98-0139-0000 Shts 1 to 4	F	3.9.93	BOM
34-0139-0000	E	3.8.93	PCB Drill RCS BD2
65-0139-0000 Shts 1 to 14	D	3.8.93	PCB RCS BD2 Artwork
BOM 53-0010-0000 Shts 1 & 2	C	3.9.93	BOM, Inductor

Schedule

Certificate of Conformity BAS No. Ex 92C2417/3 dated 4 March 1994

Number	Issue	Date	Description
BOM 97-0395-0002 Sheets 1 and 2	E	1.14.94	BOM Cable Assy, Main Board
97-0395-0001	A1	1.15.94	Cable Assy, Main and Aux Board
BOM 97-0395-0001 Sheets 1 and 2	B1	1.14.94	BOM Main and Aux Board
SCD 52-0133-0015 Sheets 1 to 4	B	1.17.94	Connector
A1719 Sheets 1 to 10	G	1.14.94	Keyboard
SCD 58-2045-0000 Sheets 1 to 4	B	1.14.94	Display
98-0139-0000	G	1.17.94	PCB Assy RCS BD2
BOM 98-0139-0000 Sheets 1 to 4	H	1.14.94	BOM
98-0139-0000	D2	1.17.94	PCB Assy RCS BD2
BOM 98-0139-0000 Sheets 1 to 4	E2	1.14.93	BOM
33-0139-0000 Sheets 1 and 2	J	1.14.94	RCS BD2 Schematic
99-0602-0000 Sheets 1 and 2	B	1.15.94	General Assembly CK4
BOM 99-0602-0000 Sheets 1 and 2	B	1.14.94	BOM HT/1121E-CK4
~~BOM 99-0601-0000~~ Sheets 1 and 2	B	1.14.94	BOM Rohrback CK4
BOM 97-0397-0001 Sheets 1 and 2	B	1.14.94	BOM Cable Assy CK4
98-0139-0001	C	1.17.94	PCB Assy RCS CK4 BD2
BOM 98-0139-0001 Sheets 1 to 4	D	1.14.94	BOM
70-0058-0004	B	1.14.94	Label

BASEEFA

British Approvals Service for Electrical Equipment in Flammable Atmospheres

CERTIFICATE OF CONFORMITY VARIATION

THIS IS TO CERTIFY THAT CERTIFICATE BAS No Ex 92C2417

Held by TERMIFLEX CORPORATION

of 316 Daniel Webster Highway, Merrimack, NH, 03054, USA

for the DATA LOGGER MODEL HT/1121E-RC

is hereby extended to apply to apparatus designed and constructed in accordance with the specification set out in the Schedule of the said Certificate but having the variation specified in the attached Schedule.

A copy of this Supplementary Certificate shall be attached to the original certificate.

File No. EECS 2997/02/001

ERA Ref: 3627/700

CERTIFICATE BAS No Ex 92C2417/3
Sheet 1/3
ref/C0082B/12A

I M CLEARE
DIRECTOR EECS
4 March 1994

Electrical Equipment Certification Service
Health and Safety Executive
Harpur Hill, Buxton, Derbyshire, SK17 9JN, United Kingdom
Tel: 0298 26211 Fax: 0298 79514 Telex: 668113 RLSD G

HSE Health & Safety Executive

BASEEFA

Schedule

Certificate of Conformity BAS No. Ex 92C2417/3 dated 4 March 1994

VARIATION SIX

To permit the following:

(i) An alternative Norwesco 'D' type connector for external connections.

(ii) A new display module

(iii) The removal of capacitor C66 and resistors R65 and R66 from RCS Board 2

(iv) Addition of an FET symbol to RCS Board 2 schematic

(v) Mechanical changes to the keyboard

(vi) An increase in the length of an internal cable

(vii) Change of sleeving specification on an internal cable

(viii) Modification to the certificate label layout

DRAWINGS

Number	Issue	Date	Description
99-0597-0000 Sheets 1 and 2	D	1.15.94	General Assembly
BOM 99-0597-0002 Sheets 1 and 2	D	1.14.94	BOM Termiflex with Aux Board
BOM 99-0597-0005 Sheets 1 and 2	D	1.14.94	BOM Termiflex w/o Aux Board
~~BOM 99-0589-0002~~ Sheets 1 and 2	F	1.14.94	BOM Rohrback with Aux Board
~~BOM 99-0589-0005~~ Sheets 1 and 2	D	1.14.94	BOM Rohrback w/o Aux Board
97-0395-0001	D	1.15.94	Cable Assy, Main and Aux Boards
BOM 97-0395-0001 Sheets 1 and 2	E	1.14.94	BOM Cable Assy, Main and Aux Board

Schedule

Certificate of Conformity BAS No Ex 92C2417/1 dated 26 March 1993

VARIATION FOUR

To permit removal of the RS-232 serial port, the audio beeper, most of the battery backed memory and certain components on the auxiliary board to form a DATA LOGGER MODEL HT/112E-CK4 or when affixed with a Trade Agent label to form a CORRDATAMATE CK-4.

DRAWINGS

Number	Issue	Date	Description
99-0602-0000 Shts 1 & 2	A	3.9.93	General Assembly-CK4
BOM 99-0602-0000 Shts 1 & 2	A	3.9.93	BOM, HT/1121E-CK4
BOM 99-0601-0000 Shts 1 & 2	A	3.9.93	BOM, Rohrback-CK4
97-0397-0001	A	3.9.93	Cable Assembly-CK4
BOM 97-0397-0001 Shts 1 & 2	A	3.9.93	BOM
SCD 97-0397-0000 Shts 1 & 2	A	3.9.93	Cable Assy Probe Data Mate 2
BOM 98-0140-001 Shts 1 & 2	A	3.9.93	BOM, PCB Assy HT/1121E BD1-CK4
BOM 89-0140-0001 Shts 1 & 2	B	3.18.93	BOM, PCB Assy HT/1121E-BD1-CK4
98-0139-0001	A	3.9.93	PCB Assy RCS BD2-CK4
BOM98-0139-0001 Shts 1 to 4	A	3.9.93	BOM
33-0139-0000 Shts 1 & 2	G	3.8.93	RCS BD2 Schematic
70-0058-0002	C	3.8.93	Label (Termiflex)
70-0058-0003	B	3.8.93	Label (Rohrback)

BASEEFA

British Approvals Service for Electrical
Equipment in Flammable Atmospheres

Certificate of Conformity Variation

THIS IS TO CERTIFY THAT CERTIFICATE BAS NO Ex 92C2417

Held by TERMIFLEX CORPORATION
of 316 Daniel Webster Highway, Merrimack,
NH 03054, USA

for the DATA LOGGER MODEL HT/1121E-RC

is hereby extended to apply to apparatus designed and constructed in accordance with the specification set out in the Schedule of the said Certificate but having the variations specified in the attached Schedule.

File No: EECS 2997/02/001

ELECTRICAL EQUIPMENT EECS CERTIFICATION SERVICE

CERTIFICATE BAS NO Ex 92C2417/2
Sheet 1/2
TG

I M CLEARE
DIRECTOR EECS
7 June 1993

ELECTRICAL EQUIPMENT EECS CERTIFICATION SERVICE

Electrical Equipment Certification Service
Health and Safety Executive
Harpur Hill, Buxton, Derbyshire, SK17 9JN, United Kingdom
Tel: 0298 26211 Fax: 0298 79514 Telex: 668113 RLSD G

HSE Health & Safety Executive

Schedule

Certificate of Conformity BAS No Ex 92C2417/2 dated 7 June 1993

VARIATION FIVE To permit changes to the Bills of Materials to align with the Schematics, and other minor changes to the drawings. Intrinsic safety is not impaired.

DRAWINGS

Number	Issue	Date	Description
33-0140-0000 Sheets 1 and 2	D2	5.25.93	HT/1121E Schematic
33-0140-0000 Sheets 1 and 2	F	5.25.93	HT/1121E Schematic
33-0139-0000 Sheets 1 and 2	H	5.25.93	RCS BD2 Schematic
98-0139-0000	D1	5.25.93	RCS BD2 PCB Assembly
98-0139-0000	F	5.25.93	RCS BD2 PCB Assembly
98-0139-0001	B	5.25.93	RCS CK4 BD2 PCB Assembly
89-0140-0000 Sheets 1 and 2	E2	5.25.93	BOM, PCB Assembly HT/1121E BD1 RS 232
89-0140-0000 Sheets 1 and 2	E3	5.25.93	BOM, PCB Assembly HT/1121E BD1 RS 232
89-0140-0000 Sheets 1 and 2	H	5.25.93	BOM, PCB Assembly HT/1121E BD1 RS 232
89-0140-0000 Sheets 1 and 2	J	5.25.93	BOM, PCB Assembly HT/1121E BD1 RS 232
89-0140-0001 Sheets 1 and 2	C	5.25.93	BOM, PCB Assembly HT/1121E BD1 32K
89-0140-0001 Sheets 1 and 2	D	5.25.93	BOM, PCB Assembly HT/1121E BD1 32K
98-0139-0001 Sheets 1-4	C	5.25.93	BOM, PCB Assembly RCS CK-4 BD2
98-0139-0000 Sheets 1-4	E1	5.25.93	BOM, PCB Assembly RCS BD2
98-0139-0000 Sheets 1-4	G	5.25.93	BOM, PCB Assembly RCS BD2

BASEEFA

British Approvals Service for Electrical Equipment in Flammable Atmospheres

1. # *Certificate of Conformity*

2. **BAS No Ex 90C2388X**

3. This certificate is issued for the electrical apparatus:

A RANGE OF CORROSOMETER PROBES

4. manufactured and submitted for certification by:

ROHRBACK COSASCO SYSTEMS INC
of Santa Fe Springs, California, 90670 USA

5. This electrical apparatus and any acceptable variation thereto is specified in the Schedule to this Certificate and the documents therein referred to.

6. BASEEFA being an Approved Certification Body in accordance with Article 14 of the Council Directive of the European Communities of 18 December 1975 (76/117/EEC) certifies that the apparatus has been found to comply with harmonised European Standards

EN50 014 (1977) + Amendments 1 to 5
EN50 020 (1977) + Amendments 1 and 2

and has successfully met the examination and test requirements as recorded in confidential Report

No 90(i)464 dated 3 October 1990

7. The apparatus marking shall include the code

EEx ia IIC T4

File No: EECS 0900/02/001

Sheet 1/5

AT

ELECTRICAL EQUIPMENT EECS CERTIFICATION SERVICE

p.p. I M CLEARE
DIRECTOR EECS
25 April 1991

Electrical Equipment Certification Service
Health and Safety Executive
Harpur Hill, Buxton, Derbyshire, SK17 9JN, United Kingdom
Tel: 0298 26211 Fax: 0298 79514 Telex: 668113 RLSD G

HSE Health & Safety Executive

Certificate BAS No Ex 90C2388X dated 25 April 1991

8. The manufacturer of the electrical apparatus referred to in this certificate, has the responsibility to ensure that the apparatus conforms to the specification laid down in the Schedule to this certificate and has satisfied routine verifications and tests specified therein.

9. This apparatus may be marked with the Distinctive Community Mark specified in Annex II to the Council Directive of 16 January 1984 (Doc 84/47/EEC). A facsimile of this mark is printed on sheet 1 of this certificate.

This certificate is granted subject to conditions applicable to the Approval Service, it does not necessarily indicate that the apparatus may lawfully be used in particular industries or circumstances.

ELECTRICAL EQUIPMENT EECS CERTIFICATION SERVICE

Electrical Equipment Certification Service
Health and Safety Executive
Harpur Hill, Buxton, Derbyshire, SK17 9JN, United Kingdom
Tel: 0298 26211 Fax: 0298 79514 Telex: 668113 RLSD G

HSE Health & Safety Executive

Schedule

Certificate of Conformity BAS No Ex 90C2388X dated 25 April 1991

APPARATUS

A Range of Corrosometer Probes designed to determine the extent of corrosion taking place over a period of time. This is achieved by closely monitoring the increase in resistance of the probe circuit as the probe cross sectional area is reduced by corrosion. Corrosion probes comprise of a number of different mechanical arrangements and may be manufactured from a number of different alloy materials.

$U_{max:in}$ = 13 V
$I_{max:in}$ = 1.8 A (at 5.63V)
$W_{max:in}$ = 3.17 W
L_{eq} = 0
C_{eq} = 0

The range consists of:-

Types S4, S10, T4, S8, W80, S20, T8, S40, T10, S8F, T20, T50 in the following materials:-

Nickel Alloys Alloy code 8042, UNS N06625, UNS N08904, UNS N05500, UNS N04400, UNS N02211, UNS N02200, UNS N02270.

Stainless Steels UNS S30900, UNS S31000, UNS S31603, UNS S31600, UNS S31700, UNS S31703, UNS S34700, UNS S30100, UNS S30200, UNS S30300, UNS S30400, UNS S30403, UNS S30500, Alloy code 8016, UNS S41400, UNS S32100, UNS 31980, UNS S34700, UNS S43000, UNS S40500, UNS S40300, UNS S42000, UNS S41000, Alloy code 8046, UNS S50200, Alloy code 8047.

Copper Alloys UNS C71500, UNS C70610, UNS C64200, UNS C60600, UNS C51000, UNS C17200, UNS C68700, UNS C44300, UNS C44500, UNS C27000, UNS C26000, UNS 23000, UNS C14200, UNS C11000.

Carbon Steels UNS G41300, UNS G10800, Alloy code 8009, UNS G10180, UNS G10220, UNS G10200, UNS G10150, UNS G10100, Alloy code 8007.

Aluminimum Alloys UNS A92024, UNS A95154, UNS A95052, UNS A94043, UNS A95356, UNS A96061, UNS A93003, UNS A96063, UNS A91100.

Schedule

Certificate of Conformity BAS No Ex 90C2388X dated 25 April 1991

Types T4, S8, W80, S20, T8, S40, T10, S8F, T20, T50 in the following materials:-

Nickel Alloys UNS N10276, UNS N08825, UNS N08020, UNS N06600

Type W40 in the following materials:-

Nickel Alloys UNS N02211, UNS N02200, UNS N02270

Stainless steels UNS S50200, Alloy code 8047

Copper Alloys UNS C70610, UNS C64200, UNS 60600, UNS C51000, UNS C17200, UNS C68700, UNS C44300, UNS C44500, UNS C27000, UNS C26000, UNS C23000, UNS C14200, UNS 11000.

Carbon Steels UNS G41300, UNS G10800, Alloy code 8009, UNS G10180, UNS G10220, UNS G10200, UNS G10150, UNS G10100, Alloy code 8007.

Aluminimum Alloys UNS A92024, UNS A95154, UNS A95052, UNS A94043, UNS A95356, UNS A96061, UNS A93003, UNS A96063, UNS A91100

For all types of probe, alternative carbon steels to match process steel work may be used provided the resistivity of the metal does not exceed 20 micro-ohms per cm.

DRAWINGS

Number	Issue	Date	Description
660079	A	15.01.91	Chart for Corrosometer Elements
660080	A	15.01.91	Typical Arrangement of replaceable insert probes
660081	A	15.01.91	Typical Arrangement of High Pressure probes.
660082	A	15.01.91	Typical Arrangement of Fixed and retractable probes

Schedule

Certificate of Conformity BAS No Ex 90C2388X dated 25 April 1991

Number	Issue	Date	Description
030633	H	29.11.90	Strip Element - Flush Mount
023003	G	29.11.90	Corrosometer Element
030822	C	29.11.90	Element - Flush
037447	J	29.11.90	Element Fabrication
037126	G	29.11.90	Element Fabrication
037085	E	29.11.90	Element Fabrication
028040	G	08.04.91	Element Assembly

SPECIAL CONDITIONS FOR SAFE USE

1. The exposed element must be housed in such a manner to provide a degree of protection of not less than IP20.

2. The element must be replaced when the "end of life resistance" is reached.

3. In most installations the probe cirucit will not be capacble of withstanding the 500 V a.c. test to earth or flame for 1 minute. If this is the case then suitable precautions must be taken in accordance with National Codes of Practice (ie in the UK BS5345 Parts 1 and 4).

British Approvals Service for Electrical
Equipment in Flammable Atmospheres

Certificate of Conformity Variation

THIS IS TO CERTIFY THAT CERTIFICATE BAS NO Ex 90C2388X

Held by ROHRBACK COSASCO SYSTEMS INC
of Santa Fe Springs, California 90670, USA

for the RANGE OF CORROSOMETER PROBES

is hereby extended to apply to apparatus designed and constructed in accordance with the specification set out in the Schedule of the said Certificate but having the variations specified in the attached Schedule.

File No: EECS 0900/02/001

CERTIFICATE BAS NO Ex 90C2388X/1
Sheet 1/2
CG

I M CLEARE
DIRECTOR EECS
12 May 1992

Electrical Equipment Certification Service
Health and Safety Executive
Harpur Hill, Buxton, Derbyshire, SK17 9JN, United Kingdom
Tel: 0298 26211 Fax: 0298 79514 Telex: 668113 RLSD G

Schedule

Certificate of Conformity BAS No Ex 90C2388X/1 dated 12 May 1992

VARIATION ONE

To permit the use of Types S4, S10, T4, S8, W80, S20, T8, S40, T10, S8F, T20 and T50 manufactured from UNS K03005 pipe grade carbon steel.

Also to permit minor mechanical changes to the flush element Corrosometer that does not affect intrinsic safety.

DRAWINGS

Number	Issue	Date	Description
660079	B	31.3.92	Chart for Corrosometer Elements
030822	D	4.2.92	Element - Flush

BASEEFA

British Approvals Service for Electrical
Equipment in Flammable Atmospheres

Certificate of Conformity Variation

THIS IS TO CERTIFY THAT CERTIFICATE BAS NO Ex 90C2388X

Held by ROHRBACK COSASCO SYSTEMS INC
of Santa Fe Springs, California 90670, USA

for the RANGE OF CORROSOMETER PROBES

is hereby extended to apply to apparatus designed and constructed in accordance with the specification set out in the Schedule of the said Certificate but having the variations specified in the following Schedule.

VARIATION TWO To permit minor changes to drawings none of which affect the intrinsic safety assessment.

DRAWINGS

Number	Sheet	Issue	Date	Description
037085	-	F	11.12.92	Element Fabrication
028040	-	H	07.05.92	Element Fabrication

File No: EECS 0900/02/001

ELECTRICAL EQUIPMENT EECS CERTIFICATION SERVICE

CERTIFICATE BAS NO Ex 90C2388X/2

TG

I M CLEARE
DIRECTOR EECS
3 March 1993

ELECTRICAL EQUIPMENT EECS CERTIFICATION SERVICE

Electrical Equipment Certification Service
Health and Safety Executive
Harpur Hill, Buxton, Derbyshire, SK17 9JN, United Kingdom
Tel: 0298 26211 Fax: 0298 79514 Telex: 668113 RLSD G

HSE Health & Safety Executive